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ABSTRACT

The instructional unit designed to develop the effective ability of farmers to produce, harvest, store, and market corn profitably is structured in 11 lessons. The unit was developed as a guide for use by teachers in planning and conducting young farmer or adult farmer classes. The specific topic areas include varieties of corn, principles of germination, fertilization programs, the identification, prevention, and control of corn diseases, weed and insect control, harvesting, storing, and marketing. Transparency and handout masters are included for each lesson. Teaching forms and a unit evaluation questionnaire are appended. (VA)

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ED112251

CORN PRODUCTION AND MARKETING

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An Instructional Unit for Teachers
of Adult Vocational Education in Agriculture

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(VT 102 055)

1974

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FOREWORD

Mr. Clyde Grade, Jr., full-time teacher of adults in agriculture for Christian County, brings to this publication 12 years of experience teaching VoAg, including three years of adult-farmer work in Hardin County and three years of teaching adult farmers in Christian County, the leading county for the production of corn in Kentucky. He holds the B.S. degree from Murray State University and the M.S. degree from the University of Kentucky. He is engaged in numerous civic and educational activities.

This adult-farmer course is a result of the following sequence of actions:

1) The State Advisory Committee, made up of agriculture teachers, State staff, and teacher educators from throughout Kentucky, was organized to determine needs and program direction for adult work in agriculture for the State. A major outcome of the first meeting in September, 1971, was a recommendation that more instructional materials that are specifically designed for teaching adults in agriculture be developed and distributed to teachers.

2) Subsequently, a proposal to involve experienced teachers of adults in material development was written by Dr. Maynard Iverson of the University of Kentucky and submitted for State funding. In January, 1972, a two-year, special grant was made through the Supporting Services Division, Bureau of Vocational Education, State Department of Education.

3) Twelve teachers were selected to produce units in the diverse areas of need during the course of the project.

This publication, along with other materials developed specifically for instruction of adults employed in agriculture in Kentucky, should improve the teaching of adult classes in agriculture and stimulate the initiation of additional classes.

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ACKNOWLEDGEMENT

We are grateful to the following for their valuable assistance with the unit: Mrs. Jane Grace, for typing the manuscript, Ms. Susan Roberts, for additional typing; Mrs. Anne Mills, for secretarial work related to the unit; Messrs. Ray Gilmore and Steve Statzer, artists in the Curriculum Development Center, for their art and photo-copying work on the unit; Mr. Shirley Phillips, Assistant Director of Extension for Agriculture (UK), for assistance in securing technical review of the manuscript; Dr. Morris J. Bitzer, Extension Grain Crops Specialist (UK) and Dr. Frank Pattie, Professor Emeritus (UK) for technical reviews of the manuscript; and especially to the many authors and firms whose publications provided information and illustrations for the unit.

SUGGESTIONS FOR USING THE COURSE

This unit was developed as a guide for use by teachers in planning and conducting young farmer and/or adult farmer classes. Because of the diversity in age, expertise, and experience levels of class members and instructors, the unit was designed to cover the basic areas of corn production. Therefore, teachers should adapt those portions of the unit that are suited to their particular situation. Eleven lessons have been included, but the unit may be expanded to more topics or utilized in diversified courses for shorter periods of instruction. It may be helpful to involve class members at the organizational meeting in the selection of lessons and activities. Planning forms to assist in this process are found in the appendix. We highly recommend that the major teacher reference, Modern Corn Production, be secured by anyone planning to utilize this unit.

The format used was designed to assist teachers in utilizing problem-solving and the discussion method. A teaching procedure that has been used successfully is as follows: Step 1: The teacher lists the topic (problem and analysis) on the chalkboard. Step 2: He then sets the stage for discussion with introductory facts, ideas, or comments, using items from the section on "developing the situation." Step 3: The teacher calls on the class to give their experiences, ideas, and knowledge concerning the subject. The discussion is supplemented with handouts, transparencies, models, or other inputs gathered by the teacher beforehand to help solve the problem under consideration. Resource people or films may also be used here as sources of information. (Transparency and handout masters are found at the end of each lesson in the unit.) Step 4: When the facts have been brought out and a good discussion has taken place, the teacher leads the group to appropriate conclusions. These summary statements are written on the chalkboard and, in some cases, are typed up and distributed as handouts at the next meeting. Some instructors will utilize devices such as panels, exhibits, and tours to reinforce the conclusions reached. Several suggestions for supplementary enrichment activities are listed in each lesson of this unit.

Teachers may want to utilize the wealth of resources found in each community to supplement their teaching -- local farmers, hybrid-seed representatives, and others will undoubtedly be pleased to serve as resource people, furnish samples, give demonstrations, conduct tours, arrange for films, and assist with other activities appropriate to the success of the course.

Each teacher using the unit is asked to complete and return the evaluation questionnaire found in the Appendix. These ratings and suggestions will be used to improve this unit as well as others developed in the future.

Our best wishes for a successful adult program.

Clyde Grace, Jr.
Development Consultant

Maynard J. Iverson
Project Director

UNIT OBJECTIVES

Major objective: To develop the effective ability of farmers to produce, harvest, store, and market corn profitably.

Lesson objectives: To develop the effective ability of farmers to:

1. Plan for profitable corn production.
2. Select adapted varieties of corn.
3. Utilize the principles involved in the germination and development of the corn plant.
4. Plan a fertilization program for the corn crop.
5. Produce corn by use of reduced tillage methods.
6. Plant corn.
7. Control weeds in corn.
8. Identify, prevent, and control corn diseases.
9. Identify and control insects of corn.
10. Harvest and store corn.
11. Market corn profitably.

UNIT REFERENCES

Listed are references that were available to the development consultant for use. There are probably several others that are not listed that will serve as good references. Many good articles on corn appear in the monthly or quarterly published farm magazines, particularly the following: Farm Journal, The Farm Quarterly, Progressive Farmer, Successful Farming Magazine, The Indiana Prairie Farmer, The Kentucky Farmer, and No-Till Farmer.

Books:

Modern Corn Production, by Samuel R. Aldrich and Earl R. Leng, The Farm Quarterly, Cincinnati, Ohio, 1965.

Advances In Corn Production: Principles and Practices, by W. H. Pierre, S. R. Aldrich, and W. P. Martin, The Iowa State University Press, Ames, Iowa, 1966, $7.90.

No-Tillage Farming, S. H. Phillips and H. M. Young, Jr., Reiman Associates, Milwaukee, Wisconsin, 1973, $9.50.

Doane's Farm Management Guide, Doane Agricultural Service, Inc., St. Louis, Missouri, 1971, $5.95.

Other Publications:

Soils and Crops, 12th Ed., A Successful Farming Book, Meredith Corporation, 1969, $1.50.

The Farm Quarterly/Crops '72, Land Media, Inc., Cincinnati, Ohio.

Corn Growers Guide, P-A-G Division, W.R. Grace & Co., Aurora, Illinois, $2.95.

Notebook - Grain Drying and Storage, by I. J. Ross, G. M. White, Douglas Overhults, Agricultural Engineering Dept., University of Kentucky, Lexington, Kentucky.

A Reference Unit on Corn, Mississippi State University, State College, Mississippi, April, 1966.

Corn, America's Greatest Crop, DeKalb Agricultural Association, Inc., DeKalb, Illinois.

Micronutrients, Swift Agricultural Chemicals Corp., Chicago, Illinois.

Corn from Bag to Bin, University of Wisconsin, Cir. 605.

Maintenance of Quality in Stored Grains and Seeds, Agricultural Extension Service, University of Minnesota, Extension Folder 226.

Corn Kernel Damage, Clemson College, Clemson, South Carolina.

Ohio State University, Columbus, Ohio, Publications:

Rate of Planting Corn, Agdex 111/22, 1963.

Seed Production of Corn, Soybeans, and Small Grains, Agdex 100/40, 1971.

A Guide for Measuring Corn Harvest Losses, AED-108.

Individual Study Guide for Drying Corn on the Farm, Agdex 111/736.

Corn - Harvesting, Handling, Marketing in Ohio, Bul. 502.

University of Illinois, Vocational Agr. Service, Urbana,Illinois, Publications:

Illinois Agronomy Handbook, 1971, Cir. 1027.

200 Bushel Corn, Is It Possible on Your Soils?, Cir. 928.

Profitable Corn Production, A Source Unit for Programs in Agr. Occupations.

Producing High Corn Yields, VAS 4039a.

Preview of Corn in Illinois in 1976, Cir. 961.

Productivity of Illinois Soils, Cir. 1016.

Economics of Narrow-Row Culture, Paper No. 65-654.

Hunger Signs in Crops, VAS 4011a.

Planning the Nitrogen Program, VAS 4009a.

Nitrates in Water Supplies, Field Crops, and Ruminant Nutrition, VAS 4050.

Where Do We Stand on Micronutrients in Illinois?, by S. R. Aldrich.

Diseases of Corn in the Midwest, North Central Regional Extension Publication No. 21.

Maize Dwarf Mosaic of Corn, VAS 4049.

Corn Stalk Rots, No. 200 (Revised).

Stewart's Leaf Blight of Corn, No. 201 (Revised).

Northern and Southern Leaf Blights of Corn, No. 202.

Common Corn Smut, No. 203.

Corn Ear Rots, No. 205.

Storage Rots of Corn, No. 206.

Corn, Insects and Their Control, VAS 4040a.

Principal Stored Grain Insects, Picture Sheet No. 1.

Corn Insects - Above Ground, Picture Sheet No. 4.

Corn Insects - Below Ground, Picture Sheet No. 5.

Storing and Drying Corn, VAS 4044.

Economic Considerations in Choosing a Corn Harvesting Method, AERR-63.

Harvesting Corn with Combines, by Wendell Bowers.

Drying Shelled Corn, Cir. 916.

U. S. Department of Agriculture, U. S. Government Printing Office, Washington, D.C. Publications:

Corn Production, Agr. Handbook No. 322.

Growing Corn, Farmer's Bulletin No. 2225.

Corn Diseases in the United States and Their Control, Agr. Handbook No. 197.

Bacterial Wilt and Stewart's Leaf Blight of Corn, Farmer's Bul. No. 2092.

University of Kentucky - Cooperative Extension Service, University of Kentucky, Lexington, Kentucky, Publications:

Agronomy Research - 1972, Misc. 402.

Kentucky Hybrid Corn Performance Test (latest release).

Growing Corn in Kentucky, Circ. 588-A.

Selecting No-Tillage Planters by Need, AEN - 2.

Reducing Corn Harvest Losses, Leaflet 307.

No-Tillage Systems for Grain Production, Leaflet 310.

No-Tillage, Its Influence on Soil Moisture and Soil Temperature, Progress Report 187.

Grain Merchandising and Future Markets in Kentucky, by Steve A. Callahan, Series No. 7.

Chemical Control of Weeds in Farm Crops in Kentucky, AGR-6.

No-Tillage Recommendations, ID-1.

Insecticide Recommendations for Field Corn, Grain Sorghum, Small Grain, and Bluegrass, Misc. 278 (latest release).

Slidefilms.

University of Illinois, Vocational Agriculture Service, 434 Mumford Hall, Urbana, Illinois.

No.	Title	Price
730A	"Producing Hybrid Seed Corn"	$3.65
731	"Planting Corn"	1.25
732	"Corn Diseases in Illinois"	3.05
733	"Determining Market Grades of Corn"	3.00
734	"Factors Affecting Classes & Grades of Shelled Corn"	2.85
791	"Identification of Weeds," Part I	2.80
792	"Identification of Weeds," Part II	2.35
794	"Controlling Giant Foxtail"	2.70
796	"Seed Quality - A Major Factor in Crop Yields"	2.75
797	"Using Pre-emergence Herbicides"	2.95
798	"Recognizing Herbicide Injury"	3.45
799	"A Systematic Approach to Weed Control"	3.25

Movies:

John Deere Film Library, 201 South Jefferson, St. Louis, Missouri 63103.

"Cornbelt Special - New Varieties, New Techniques"
"Lock in Grain Profits by Hedging"

Modern Talking Picture Service, 3 East 54th Street, New York 22, New York.

"Soil Insect Control"

The Farm Film Foundation, 1425 H. Street, N.W., Washington, D. C. 20005.

"Grain Exchange"
"Great Story of Corn"
"New Corns for a Great Harvest"

The Venard Organization, Peoria, Illinois, 61602.

"Great Story of Corn"
"Breeding Better Corn"
"High Profit Trio"
"Key to Corn Profits"
"The 304 Bushel Challenge"
"Why Dry Corn"

Geigy Agricultural Chemicals, Ardsley, New York 10502.

"Herbicides - Fundamentals of Proper Application"

Introduction

HISTORY AND GENERAL INFORMATION

Corn is the truly American crop, grown in almost all states. It is the unique crop which has gone far toward making this country one of the most prosperous and one of the best fed in the world. The U. S. produces nearly three-fifths of all the corn grown in the world.

Corn is a very old crop; evidence based on lake sediments near Mexico City indicates corn originated at least 60,000 years ago. It was being grown in what is now the East coast of the United States by Indians in 1492. It was estimated that some 50,000 acres were grown. The Indians had done much to improve the quality and yield before the coming of the white man. They had developed the southern dents for the southern climate and the northern flints for the northern climate.

Corn had many values for the early white man. It was a very valuable item for the human diet, a major source of feed for livestock, and it was used in making whiskey which was widely accepted as legal tender at a dollar per gallon.

Corn today is used mainly for livestock feed (88%), since it is the number one grain for finishing swine and beef cattle.

The amount of corn produced in this country has increased dramatically since the turn of the century. The following example shows 10 year periods, with amounts given in billions of bushels.

1890	1.46
1900	2.50
1910	2.85
1920	3.07
1931	2.50
1940	2.45
1950	3.05
1960	4.40
1971	5.50

The introduction of hybrid corn in 1930 was a major impact on corn production in the U.S. The average yield per acre has increased with the increased use of hybrids, as follows:

1930-39	23.4 bu. per acre
1940-49	33.9 bu. per acre
1950-59	43.0 bu. per acre
1960-69	62.7 bu. per acre

The percentage of crop planted to hybrid seed during that period of time is seen below:

1935	1.1%
1940	30.5%
1945	64.4%
1950	78.0%
1955	89.2%
1960	95.9%
1965	97.4%

Corn will continue to be in demand in future generations for livestock feed, human consumption, and other uses. Breeders will continue to improve corn in various ways. Some of the types of improvements to be expected are better standability; higher yields; resistance to corn borer, stalk rots, and leaf blights; and improved protein content. Other possible improvements are dwarf corn, multiple-eared corn, and crosses between corn and related crops.

In Kentucky there were 1,377,000 acres of corn grown in 1971, and 86 bushels per acre was the average yield; this gave a total production of 83,248,000 bushels worth $142,778,000 to the economy.

The future looks bright for corn production in Kentucky. There is a greater demand for corn in the state than the amount of present production. The use of new methods of production, such as no-till, will undoubtedly increase the corn production for the state.

Lesson 1

PLANNING FOR CORN PRODUCTION

Objective -- To develop the effective ability of farmers to plan for profitable corn production.

Problem and Analysis -- What must we do to have profitable returns from corn production?

-Place of corn production in Kentucky
-Outlook for corn
-Levels of production for optimum profit
-Present trends in corn production
-Present problem areas in corn production

Content

I. Place of Corn in Kentucky. Corn is grown on more acres in the United States (66,753,000 in 1972) than any other crop and is exceeded only by hay in Kentucky (1,131,000 acres of corn in 1972). Corn is well adapted to Kentucky farms. In 1972 the average yield was 86 bushels per acre with a total production of 83,248,000 bushels. Corn is second only to tobacco in Kentucky in value of crops produced ($142,778,000 or 20.9% of the total value of all crops in 1971). Corn is a valuable crop on livestock farms as grain or silage. Corn works well in a row-crop farm program, particularly a double-cropping arrangement (corn-small grains-soybeans, produced in a two-year period).

II. The Outlook for Corn. The outlook is important in planning the cropping program. The amount of corn carried over from the previous year's production, prospective corn plantings for the coming year, other feed grains carry-over and prospective plantings, number of cattle on feed, sow and pig numbers, and futures prices are all factors to consider when planning the amount of corn to grow.

III. Levels of Production for Optimum Profit

A. The level of production to obtain for a given farm should be determined by factors which influence production:
   1. The productivity of the soil
   2. The farmer's management ability
   3. Production practices being used
   4. Optimum use of inputs of production
   5. Farmer's attitude toward the use of recommended improved practices.

B. The decision to increase corn yield should be based upon using the resources at the optimum rate to secure the optimum level of production.

IV. Trends in Corn Production. Corn acreage has decreased but yield per acre has increased over the past years, resulting in a fairly stable number of bushels produced annually. More acres are being converted to soybean production, but in a steady or increasing livestock population there will continue to be a high level of demand for corn.

V. Problem Areas. Increases in corn yields have slowed in the past years, since most farmers are now using the recommended, improved practices of production. Future improvement of corn production must be made by those not now using the recommended practices to their optimum level, or by improvement of the corn varieties. Some future improvements seen are multiple ear varieties, crossing with other plants, reduced stalk height, improved disease and insect resistance, and improved standability.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Statistics on corn produced in the United States, Kentucky, and the local or county area.
2. The amount of other grain crops being produced statewide and locally.
3. Supply of grain available, including carry-over.
4. Number of cattle and hogs on farms in U. S.
5. Acres of corn compared to acres of other crops grown in the county.
6. Trends in the number of acres used for corn and other crops in the county.
7. How total production and yield per acre in the county compared with state data.
8. The cost of producing a bushel of corn.
9. Factors influencing yields and cost of production.
10. Problems that exist in corn production.

B. Things to be secured from class members:
1. The acreage and yield per acre on class members' farms.
2. Corn acreage the past year compared with previous years.
3. The present corn acreage compared with other crops grown in the farming program.
4. Reasons for growing corn in the cropping program.
5. Their yield goals.

6. Their cost of production.
7. New practices they are using.
8. Problems they are having.
9. Problems they think need to be considered by the class.

II. Conclusions

A. Determine the demand outlook for corn. Plan cropping program to take advantage of any increased demand.

B. Know the productive potentials of your land.

C. Look at your cost of production for crops grown in the cropping program and the returns from each. Corn should show a profitable return if it is to be in the cropping program.

D. Set attainable goals in production.

E. Plan to use all the recommended practices which will improve your production.

III. Enrichment Activities

A. Have each class member growing corn set attainable yield goals. Collect, summarize, and display information concerning the acreage and yield of class members.

B. Obtain from members expected problems that may be encountered in reaching their goals.

C. List the problems they suggest and determine the order they will be undertaken in class meetings.

IV. Suggested Teaching Materials

A. References

1. Profitable Corn Production, University of Illinois publication.
2. Preview of Corn in Illinois in 1976, University of Illinois publication, Circular 961.
3. Approved Practices for the Corn Enterprise, University of Illinois publication.
4. Preparing to Grow Corn, University of Kentucky, teaching unit HS 25.
5. A Reference Unit on Corn, Mississippi State University publication.
6. Growing Corn in Ohio in 1971, Cooperative Extension Service, The Ohio State University.
7. Kentucky Agricultural Statistics, (latest edition).
8. Kentucky Crop and Livestock Reporting Service Reports:

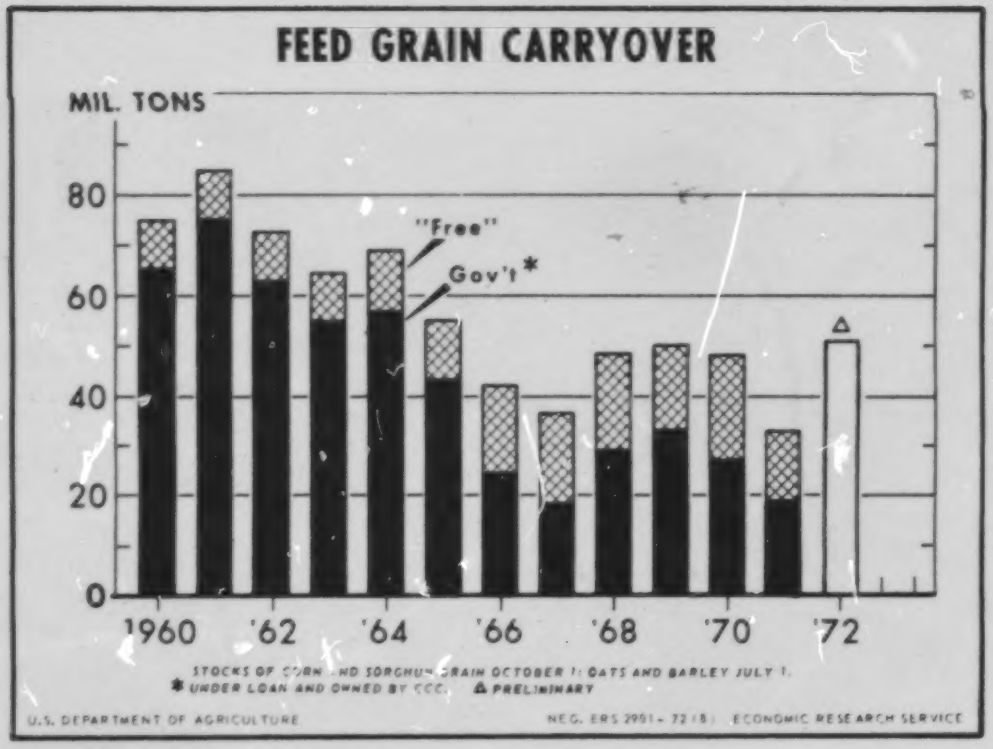
Farm Report Prospective Plantings Grain Stocks Crop Values Agricultural Prices Hogs and Pigs Livestock Cattle on Feed	U.S. Dept. of Agriculture Statistical Reporting Service P. O. Box 1120 Room 446 P. O. Building Louisville, Ky. 40201

B. Audio-visuals

1. Masters*

-1 Feed Grains: Carryover Stocks
-2 Corn Supply and Utilization
-3 Corn: Farm Prices and Support Rates Per Bushel
-4 Costs Per Acre of Producing Corn
-5 Economic Potential for Corn in Kentucky

*Masters are keyed to units and lessons and are numbered consecutively. The code number appears in the lower right hand corner. Master "107-1-1A" indicates: adult unit number 107 - lesson 1, item 1, part A.

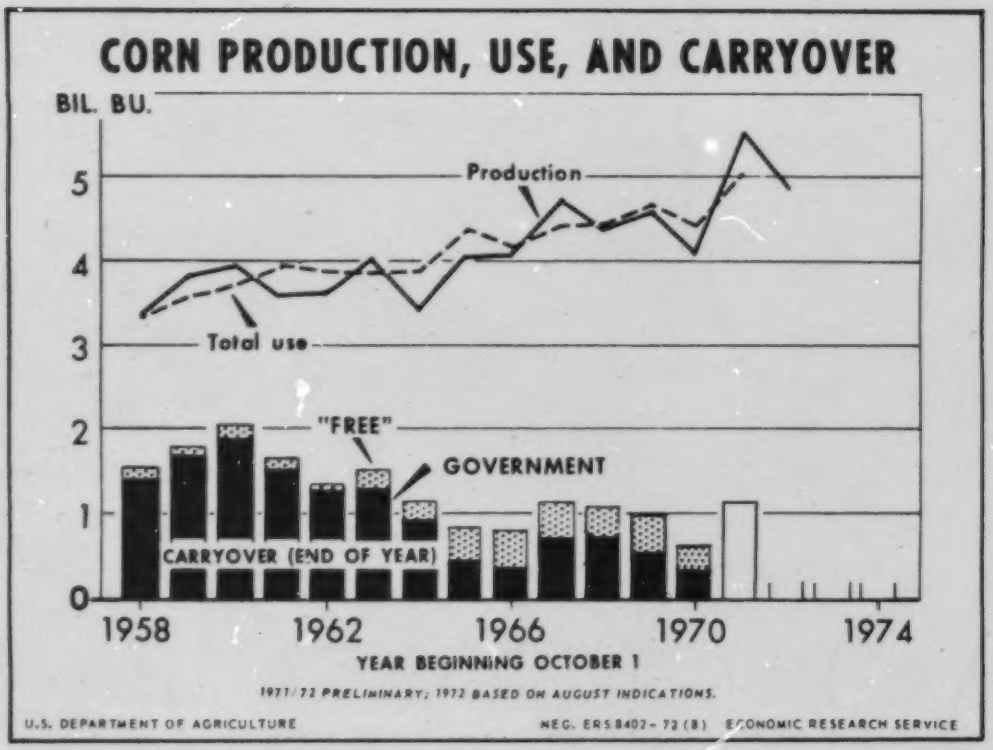


Feed grains: Carryover stocks

Year[1]	Corn	Grain sorghum	Oats	Barley	Four feed grains		
					Government	"Free"[2]	Total
	Million bushels	*Million bushels*	*Million bushels*	*Million bushels*	*Million short tons*	*Million short tons*	*Million short tons*
1960	1,787	581	267	167	65.7	8.9	74.6
1961	2,016	702	324	152	74.7	10.3	85.0
1962	1,653	661	276	123	62.5	9.7	72.2
1963	1,365	655	273	146	55.8	8.6	64.4
1964	1,537	649	312	132	56.6	12.7	69.3
1965	1,147	566	277	100	43.7	11.1	54.8
1966	840	391	316	105	24.4	17.7	42.1
1967	823	244	270	122	18.3	18.8	37.1
1968	1,167	289	273	138	29.5	18.8	48.3
1969	1,113	288	375	199	33.6	16.4	50.0
1970	999	246	490	237	27.8	20.6	48.4
1971[3]	663	91	512	156	19.0	14.0	33.0
1972[3]	1,150	160	549	174	---	---	50.0

[1] Corn and grain sorghum, October 1; oats and barley, July 1.
[2] Privately owned stocks.
[3] Preliminary; corn and grain sorghum based on August indications.

107-1-1



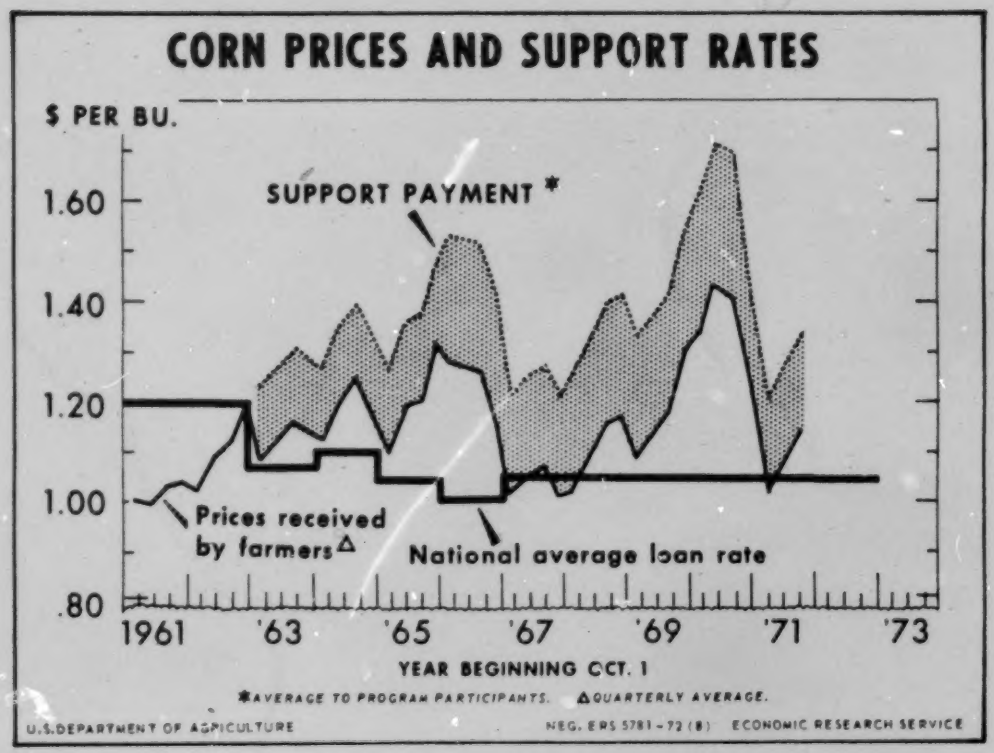
Corn: Supply and utilization

Year beginning October 1	Supply						Utilization		
	Carryover			Production	Imports[3]	Total	Domestic use	Exports[3]	Total
	Government[1]	"Free"[1]	Total						
	Million bushels	*Million bushels*	*Million bushels*	*Million bushels*	*Million bushels*	*Million bushels*	*Million bushels*	*Million bushels*	*Million bushels*
1958	1,355	114	1,469	3,356	1	4,826	3,072	230	3,302
1959	1,400	124	1,524	3,825	1	5,350	3,333	230	3,563
1960	1,675	112	1,787	3,907	1	5,695	3,387	292	3,679
1961	1,890	126	2,016	3,598	1	5,615	3,527	435	3,962
1962	1,535	118	1,653	3,606	1	5,260	3,479	416	3,895
1963	1,275	90	1,365	4,019	1	5,385	3,348	500	3,848
1964	1,300	237	1,537	3,484	1	5,022	3,305	570	3,875
1965	924	223	1,147	4,084	1	5,232	3,705	687	4,392
1966	437	403	840	4,117	1	4,958	3,648	487	4,135
1967	374	449	823	4,760	1	5,584	3,789	633	4,422
1968	714	448	1,162	4,393	1	5,556	3,907	536	4,443
1969	736	377	1,113	4,583	1	5,697	4,086	612	4,698
1970	543	456	999	4,099	4	5,102	3,922	517	4,439
1971[4]	330	333	663	5,540	1	6,204	4,304	750	5,054
1972[5]			1,150	4,948	1	6,099			

[1] Under loan and owned by Commodity Credit Corporation.
[3] Privately owned stocks; residual.
[3] Includes grain equivalent of products.
[4] Preliminary.
[5] Based on August 1972 indications.

Data published currently in the *Feed Situation* (ERS).

107-1-2



Corn: Farm prices and support rates per bushel

Year beginning Oct. 1	Average prices received					Average support payment to participants[1]	Season average price plus payments	National average loan rate[2]
	Oct.-Dec.	Jan.-Mar.	Apr.-June	July-Sept.	Season average			
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1961	1.00	0.996	1.03	1.04	1.10	---	---	1.20
1962	1.02	1.09	1.12	1.20	1.12	---	---	1.20
1963	1.08	1.12	1.16	1.14	1.11	0.15	1.26	1.07
1964	1.12	1.20	1.25	1.19	1.17	.15	1.32	1.10
1965	1.09	1.19	1.20	1.32	1.16	.17	1.33	1.05
1966	1.28	1.27	1.26	1.15	1.24	.25	1.49	1.00
1967	1.01	1.05	1.07	1.01	1.03	.20	1.23	1.05
1968	1.02	1.09	1.16	1.17	1.08	.24	1.32	1.05
1969	1.09	1.13	1.18	1.30	1.15	.24	1.39	1.05
1970	1.33	1.43	1.41	1.22	1.33	.28	1.61	1.05
1971[3]	1.02	1.09	1.14	----	1.08	.19	1.27	1.05
1972								1.05

[1] Computed on the basis of total price support payments and the estimated production on participants' farms.
[2] Available to producers participating in the feed grain program.
[3] Preliminary except loan rate.

Data published currently in the *Feed Situation* (ERS).

107-1-3

COSTS PER ACRE OF PRODUCING CORN

	Corn (100 bushels)
Variable Costs	
Fertilizer and Lime	$20.00
Seed	8.00
Machinery Operation	15.00
Chemicals	5.00
Total Variable Costs	$48.00
Fixed Costs	
Mach. and Equip. Depreciation	$12.00
Building Depreciation	3.00
Labor Charge	10.00
Land Charge	25.00
Taxes	3.00
Total Fixed Costs	$53.00
Total All Costs	$101.00

107-1-4

Source: Kentucky Agri-Business Spotlight, no. 35, Feb., 1973.

STATE SUMMARY - AGRONOMIC CROPS

Crop	Acres	Base Year 1972 Av. Yield Per Acre	Total Production	Total Value[1] (Dollars)
Tobacco (burley)	156,000	2,675 lbs.	417,300,000 lbs.	338,847,600
Tobacco (dark)	16,250	1,811 lbs.	29,425,108 lbs.	16,015,738
Cotton	5,000	397 lbs.	1,985,000 lbs.	545,875
Corn	968,000	86 bu.	83,248,000 bu.	94,319,984
Grain Sorghum	20,000	68 bu.	1,360,000 bu.	1,183,200
Soybeans	924,000	27 bu.	24,948,000 bu.	73,846,080
Wheat	215,000	32.5 bu.	7,020,000 bu.	10,319,400
Barley	70,000	40 bu.	2,800,000 bu.	2,828,000
Oats	10,000	41 bu.	410,000 bu.	315,700
Rye	3,000	29 bu.	87,000 bu.	113,970

Crop	Acres	1980 Potential Av. Yield Per Acre	Total Production	Total Value[1] (Dollars)
Tobacco (burley)	171,600	2,675 lbs.	459,030,000 lbs.	72,732,360
Tobacco (dark)	16,250	1,811 lbs.	29,425,108 lbs.	16,015,738
Cotton	3,500	700 lbs.	2,450,000 lbs.	673,750
Corn	1,515,639	96 bu.	145,501,344 bu.	164,416,519
Grain sorghum	40,000	78 bu.	3,120,000 bu.	2,714,000
Soybeans	1,806,468	33 bu.	59,613,444 bu.	176,455,579
Wheat	297,888	45.4 bu.	13,524,115 bu.	19,880,449
Barley	111,813	68.3 bu.	7,636,828 bu.	7,713,196
Oats	15,000	60 bu.	900,000 bu.	693,000
Rye	2,000	33 bu.	66,000 bu.	86,460

Crop	Acres	Long-Term Potential Av. Yield Per Acre	Total Production	Total Value[1] (Dollars)
Tobacco (burley)	187,200	2,675 lbs.	500,760,000 lbs.	406,617,120
Tobacco (dark)	16,250	1,811 lbs.	29,425,108 lbs.	16,015,738
Cotton	2,000	800 lbs.	1,600,000 lbs.	440,000
Corn	2,731,448	114 bu.	311,385,072 bu.	351,865,131
Grain sorghum	80,000	90 bu.	7,200,000 bu.	6,264,000
Soybeans	2,487,161	46 bu.	114,409,406 bu.	338,651,842
Wheat	662,998	53 bu.	35,138,894 bu.	51,654,174
Barley	290,531	74.5 bu.	21,644,456 bu.	21,860,901
Oats	15,000	72 bu.	1,080,000 bu.	831,600
Rye	2,000	40 bu.	80,000 bu.	104,800

Source: Agricultural Potentials for Kentucky

107-1-5

Lesson 2

SELECTING ADAPTED VARIETIES OF CORN

Objective -- To develop the effective ability of farmers to select adapted varieties of corn.

Problem and Analysis -- What varieties of corn should I grow?

- Use of hybrid varieties
- Factors to consider in selecting varieties of corn
- Types of hybrid crosses
- Seed grades
- Obtaining information on varietal performance

Content

I. Use of Hybrid Varieties

A. The use of hybrid varieties of corn is a common practice by present-day farmers. Hybrid varieties of corn have many advantages over the old open-pollinated varieties, including higher yield, better standability, disease and insect resistance, and more uniformity in appearance and maturity. Using hybrid varieties has replaced the practice of going to the field or crib and selecting next year's seed corn, since hybrid varieties will not produce as well when used as a second generation F_2.

B. You can't judge the performance of hybrid corn by the looks of the seed. Hybrids have their own personalities and capabilities. Since they have different parents and ancestors, they differ in their ability to do specific jobs.

II. Factors to Consider in Selecting Varieties

A. Maturity. A variety should be physiologically mature 10 days or more before frost. A variety that matures too early will usually yield less and some years may lodge more because of stalk rots. Growing a variety with very late maturity may result in yield loss from frost or spoilage if harvested and stored at high moisture levels. In western Kentucky, a medium-full season hybrid works well in a double-cropping program after wheat.

1. Some advantages in using these early varieties (70 - 80 days) are:

a. Increased tolerance to cooler spring temperatures, resulting in less difficulty in obtaining early stands.

b. Pollination takes place usually before high temperatures inhibit pollination.

c. The corn has greater strength to resist insect and disease problems as they develop.

d. Planted early, early corn usually develops to the point where it escapes serious drought damage.

e. Early harvested corn nearly always means selling on an old-corn market, thus higher prices are realized. (This may not hold true in double-cropping.)

f. Improved harvest conditions and fewer delivery problems.

g. Other farmwork and fall seeding can be done on schedule.

2. Some disadvantages are:

a. Higher cost per acre for seed because of higher seeding rate.

b. Standability problems if corn is allowed to field-dry below 18% moisture.

c. Early corn should be planted in narrow rows to obtain desirable yields (may mean changing equipment).

d. Weeds are more of a problem because of short stalks.

e. It is difficult to determine maturity of corn, thus presenting problems deciding when to spray with some herbicides.

B. Yield. It is not a simple, inherited, easily predicted characteristic. No one can tell from the number of ears, size of ear, number of kernel rows, length of ear, or kernel size whether one hybrid will outyield another hybrid. Check performance test records for several years in your area, and weigh yields on your own farm.

C. Standability. A maximum of 10% lodging any year. Since harvest is now by machine, standability is absolutely essential. Some of the causes of standability problems are disease, insect damage, and improper plant population.

D. Disease Resistance. Most problems are from Northern leaf blight (Helminthosporium turcicum), Southern leaf blight (Helminthosporium Maydis), MDM (Maize Dwarf Mosaic), corn smut, Gibberella and Diplodia stalk rots, ear rots (Gibberella, Diplodia, Fusarium, and Nigrospora), and MCDV (Maize Chlorotic Dwarf Virus).

E. Insect Resistance. To corn borers, aphids, rootworms, and earworms.

F. Adaptability. For the greatest profit, a hybrid should yield and stand relatively well in favorable and unfavorable conditions. One that will perform well under nearly all conditions should be preferred to one which is a high yielder one year and low the next year.

G. Uniformity of Seed. Sizing is important to the degree that it affects the desired planting rate.

H. Stress Tolerance. No more than 5% ear-barren plant.

III. Types of Hybrid Crosses (NOTE: See master on how hybrid crosses are produced.)

A. Single Cross. Produced from two parental inbred lines, this cross has become very popular with farmers in recent years because of its uniformity (plant type, ear height, and general appearance) under ideal conditions. Under poor conditions, the uniformity sometimes becomes a disadvantage (pollination, disease, insects, drought, and high population). The single cross has higher yield potential, under ideal conditions, than the other crosses.

B. Double or 4-Way Cross. Made up of four parental inbred lines, the four-way cross was, at one time, the most frequently used cross. There is less uniformity in this cross.

C. Three-Way Cross. Three inbred lines are useful for this cross. It is best where it has been found that an inbred line with exceptional vigor and many desirable characters will carry over to the progeny when not crossed with another inbred line.

IV. Seed Grades. In choosing a variety of hybrid corn, grading is important. Corn should be sized (medium flats, large flats, small rounds, large rounds, etc.) uniformly to insure proper drop by the planter. Grading should also insure that damaged kernels (cracked, rotten, and insect damaged) are not in seed corn purchased. Small seed are usually cheaper while large seed will produce more vigorous seedlings, although not necessarily larger yields.

V. Securing Information on Varietal Performance. When purchasing seed corn, information regarding varieties may be obtained from various sources:

A. The state universities conduct tests on varieties as to yield, standability, population (normal and high), tolerance, and virus resistance.
B. County extension agents and vocational agriculture teachers usually know which are the better performing varieties in the county.
C. Seed corn companies have information concerning their different varieties, and some companies have test plots in leading corn-growing counties.
D. Leading corn producers in a county can provide valuable information regarding varieties.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. The reasons why use of hybrid varieties has become a common practice among farmers.
2. Factors to consider when selecting a variety.
3. Varieties that have done well in the community over the past years.
4. Kinds of hybrid crosses sold and ways they are produced.
5. Considerations they should give when selecting grades of seed.

B. Things to get class members to bring out:
1. Why they plant the varieties of corn they do.
2. Experiences they have had with new varieties.
3. Problems they have had with varieties.
4. If they try to use different maturing varieties and the planting pattern used.
5. Their opinions regarding what they have observed of varieties in test plots.

II. Conclusions

A. Use hybrid varieties of corn because of higher yields, disease and insect resistance, standability, and uniformity of maturity.

B. Select varieties that yield well and have resistance to your particular farm's problems.

C. Use different maturing varieties to insure against drought, insect, or disease problems, and avoid crowding the harvest season.

D. Select a grade of seed (small round, medium flat, etc.) based on price, planting conditions, and your planter.

III. Enrichment Activities

A. Show varietal test-plot results of university experiment stations, seed companies, and local farmers.

B. Set up a varietal test plot in the local community.

C. Visit the university experiment station to observe varietal test-plots.

D. Develop a list of seed corn companies that are represented in the community and their best varieties for the community.

IV. Suggested Teaching Materials

A. References

1. Modern Corn Production, by Aldrich and Leng, pp. 29-36.
2. Corn Production, Agr. Handbook No. 322, U.S.D.A., p. 19.
3. Profitable Corn Production, Iowa State University Pm. 409, pp. 3-4.
4. Corn From Bag to Bin, University of Wisconsin, Cir. 605, p. 6.
5. Soils and Crops, 12th Ed., Successful Farming, p. 23.
6. Crops 72, The Farm Quarterly, p. 70 .
7. Seed Production of Corn, Soybeans, and Small Grains, Ohio State University, pp. 28-36.
8. Growing Corn in Kentucky, Ky. Circular 588-A, p.4.
9. Kentucky Hybrid Corn Performance Test, P.R. 190., (latest edition).
10. Growing Degrees Days for Corn in Kentucky, Ky. Progress Report 197.

B. Audio-visuals

1. Masters
   -1 Terminology in Seed Corn
   -2 AB Kinds of Hybrid Crosses

2. Filmstrips
   -"Producing Hybrid Seed Corn," VAS, University of Illinois, No. 730 A, $3.65.

3. Films
   "Great Story of Corn," Farm Film Foundation
   "Breeding Better Corn," The Venard Organization
   "High Profit Trio," The Venard Organization
   "Tall Returns from Short Corn," John Deere Films

TERMINOLOGY IN SEED CORN

Type - A group of varieties so similar that individual varieties cannot be told apart, except under test conditions.

Strain - A term sometimes used to designate an improved selection of a variety.

Blend - A term sometimes applied to mixtures of lots of seed within or between varieties but is not the same as a variety.

Common - A term applied to seed that cannot be identified as to a particular variety, and is usually a mixture.

Brand - The trademark of a particular seed company. The brand precedes the variety name. Variety names cannot be trademarked.

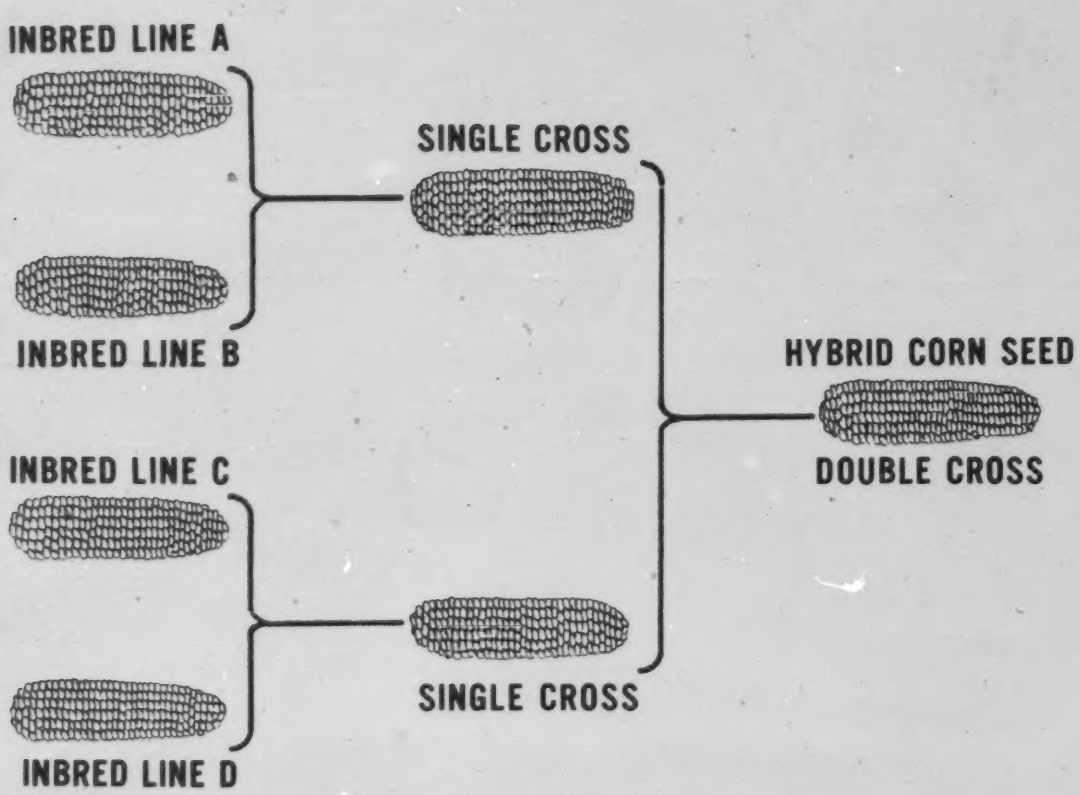
Hybrid - A term sometimes confused with variety. Hybrid refers to a method of producing seed involving certain type crosses. Corn hybrids are identified by a number or a combination of numbers and letters.

SOURCE: Seed Production, p. 28.

107-2-1

KINDS OF HYBRID CROSSES

-Double Cross

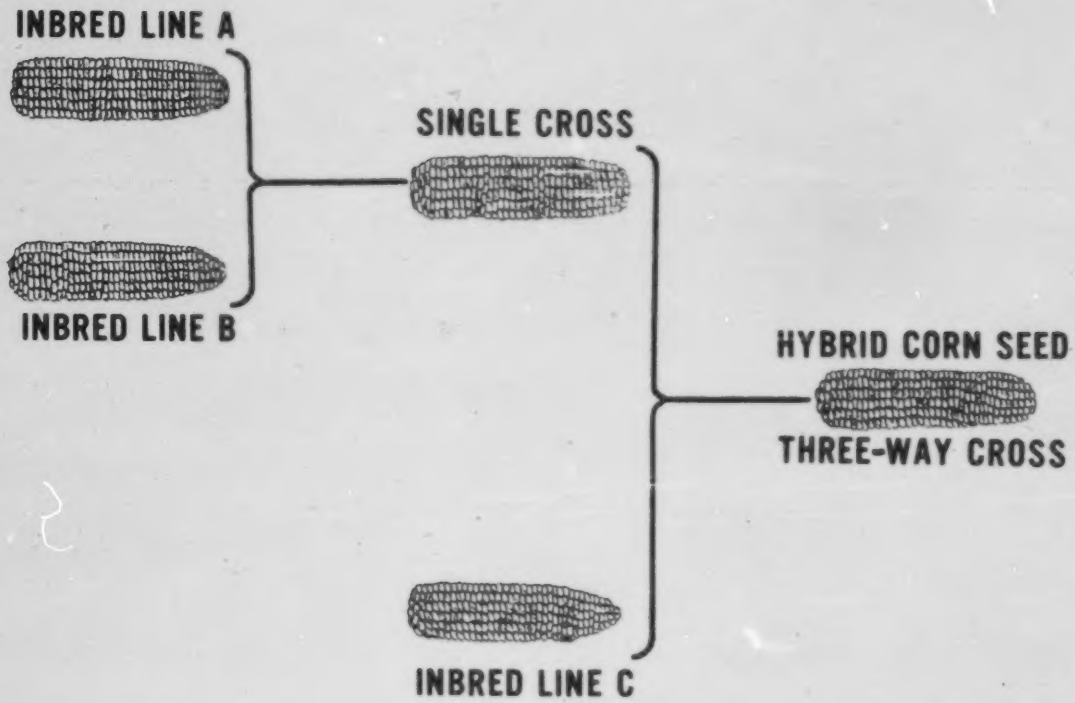


SOURCE: Seed Production, p. 32

107-2-2A

KINDS OF HYBRID CROSSES

-Three-Way Cross



SOURCE: Seed Production, p. 35.

107-2-2B

Lesson 3

UNDERSTANDING THE GERMINATION AND DEVELOPMENT OF THE CORN PLANT

Objective -- To develop the effective ability of farmers to utilize the principles involved in germination and development of the corn plant.

Problem and Analysis -- How does the germination and development of the corn plant affect management practices?

Parts of a corn kernel
Stages of germination
Stages of plant growth
Critical stages in life of corn plant
Parts of a corn plant and their functions

Content

I. The mature corn kernel is made up of three main parts -- the seed coat - pericarp, starchy endosperm, and the germ - embryo. The pericarp receives all its tissues from the mother plant. It serves to protect the seed both before and after planting by limiting or preventing entry of damaging organisms. The endosperm inherits two-thirds from the mother plant and the other third from the male plant. It is the main energy reserve of the kernel (4/5 of the whole kernel by weight in dent corn), its composition being 90% starch, 7% protein, and 3% oils, minerals and other chemicals. The pericarp provides the food energy for the young plant until its leaves and roots are able to provide its food. The embryo is made up of the embryo axis or new plant, and the scutellum, which is a rich storehouse of food for the developing seedling. In the mature kernel, the embryo axis consists of a plumule (leafy part) in which 5 to 6 embryonic leaves and a radicle (rootlike portion) are already formed in miniature.

II. The germination of the corn kernel begins promptly after planting if moisture and temperature conditions are favorable. If conditions are favorable, the following stages will take place: in 2 to 3 days after planting the radicle elongates and emerges from the seed coat; shortly thereafter the plumule elongates and additional leaves begin to form inside this part (called coleoptile after it breaks out of the seed); other seed roots (seminal) develop; a tubular white, stemlike part, the mesocotyl will elongate about half the distance to the surface; lengthening of the coleoptile brings the leafy parts the rest of the way above ground at about 6 to 10 days after planting; as soon as this part reaches the light, it splits at the tip and two true leaves unfold in rapid succession; and the next leaves come out of the whorl one every 3 days. About 30% of its weight in water absorption is required to germinate a corn kernel.

III. The stages of growth of the plant after germination are: vegetative development, tassel and ear initiation, flowering (pollen shed and silking), kernel development and maturation, and maturity and drying.

IV. There are four critical stages in the life of a corn plant when shortages of moisture or plant nutrients or other factors have very much influence. Germination and seedling establishment are the first critical times. If the soil is too wet, too dry, or too cold, germination may be slow or the young seedling may die before it is established. The most critical stage is the last three weeks before tassel emergence and pollen shed. This is the stage when tassel and pollen formation take priority over ear and silk formation; therefore, if a shortage occurs at this stage the results may be barren stalks. The third critical time is during pollen shed and silking, when a difficulty may cause a delay of silking resulting in pollen shed before silking. The last critical period is during kernel development, which is less critical than the last two on the effect of the yield. Conditions at this time will determine kernel size and ear fill.

V. The parts of a corn plant are: roots, stem, leaves, male flower (tassel), and female flower (ear).

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. The parts of the corn kernel and their functions.
2. How germination takes place.
3. The stages of growth for a corn plant.
4. The changes that take place in each stage of growth.
5. The stages of growth when moisture and nutrient demands are high.
6. The parts of a corn plant and the functions each performs.

B. Things to get from class members:
1. What they have observed in germination of corn under various conditions.
2. The yields they have obtained when they observed shortages or difficulties during different stages of development.
3. How they fertilize and till to provide the needs of plant food and moisture for the plant.

II. Conclusions

A. Every producer should recognize the parts of the corn kernel, and know the function of each part and utilize this knowledge in selecting seed and planting.

B. Know when the demands are high for plant food and moisture so you can provide the fertility needs and if irrigation should be used, the best time to irrigate.

III. Enrichment Activities

A. Have kernels of corn or chart of a kernel to show the parts.

B. Have a chart or start germination of a kernel to let members see how a corn kernel germinates.

C. Use a real plant or chart to show all the parts of the corn plant and how they develop.

D. Develop a chart showing, by periods of the year, the stages of growth of a corn plant.

E. Engage the class in an identification of management practices which a knowledge of the corn plant will help them to follow.

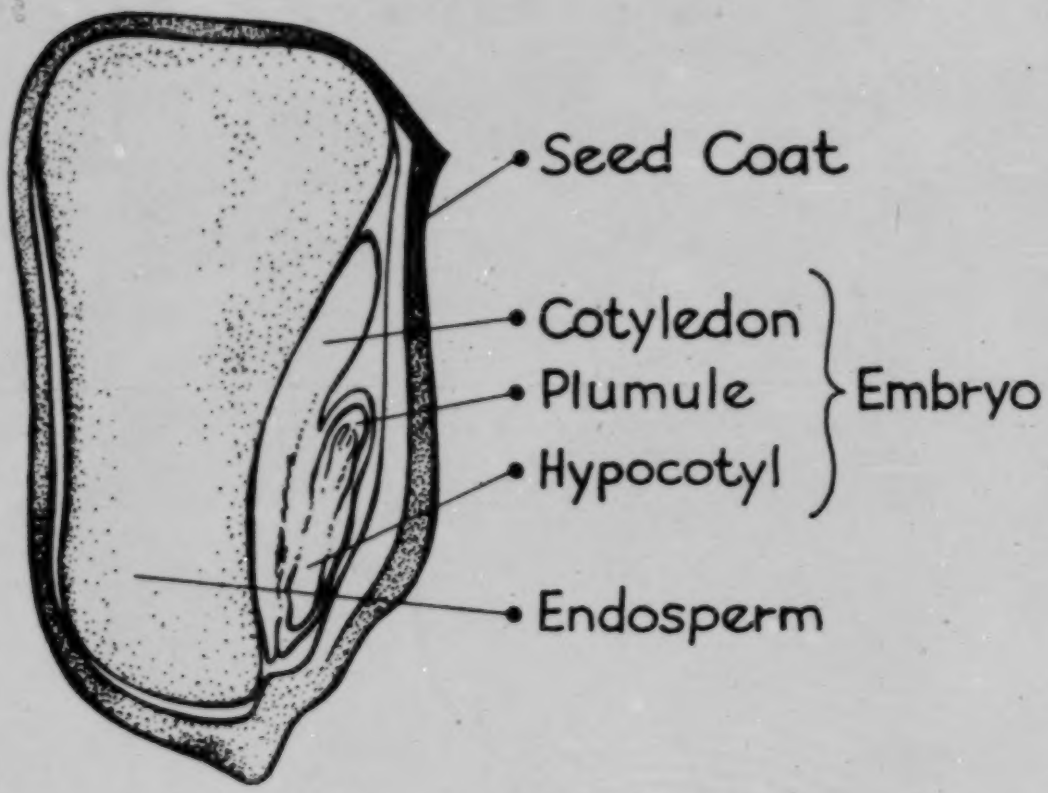
F. Provide the class with information of the amount of each nutrient needed for various yields. Use soil test reports of their farms to determine the amount of fertilizer they need to apply for the yield they desire.

IV. Suggested Teaching Materials

A. References
1. Modern Corn Production, by Aldrich and Leng, pp. 1-15.
2. A Reference Unit on Corn, Mississippi State U. Agr. Edu. Dept., pp. 15-16.
3. Profitable Corn Production, University of Illinois, p. 7.
4. Corn Production, U.S.D.A. Agr. Handbook No. 322, pp. 1-3.

B. Audio-visuals.
1. Masters
-1 Structure of a Corn Kernel.
-2 Dry Weight of Maturing Corn
-3 Functions of Leaves, Stems, Roots

STRUCTURE OF A CORN SEED (MONOCOTYLEDON)



T.VANTREESE, INST. MATL. LAB., U.K.

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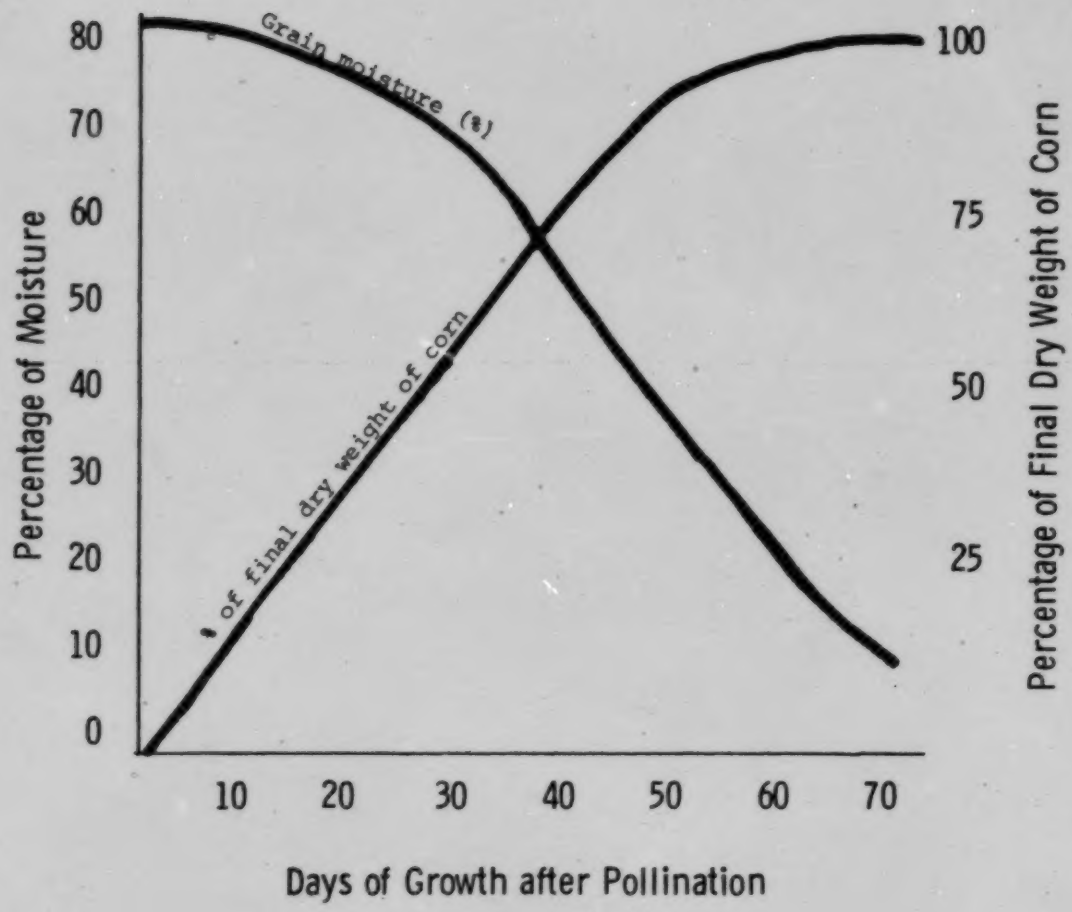
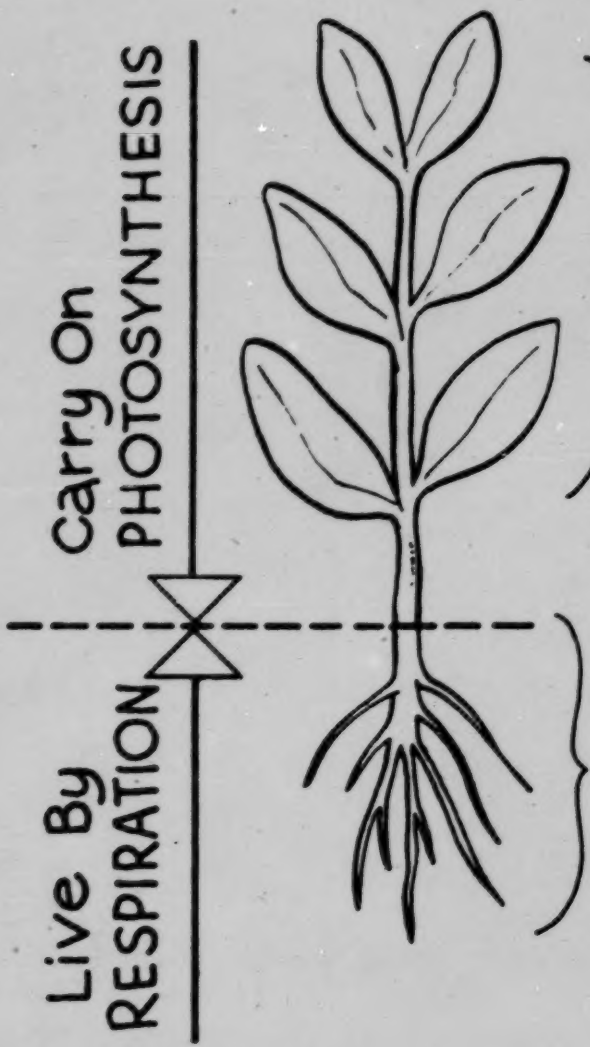
DRY WEIGHT OF MATURING CORN



107-3-2

FUNCTIONS of PLANT PARTS



GREEN PARTS
-Leaves (and sometime other parts) Convert Inorganic Matter Into Food (Organic Matter) For Animals and Roots Below Ground.

NON-GREEN PARTS
-Roots (and other parts) Carry Inorganic Matter to Green Parts.

107-3-3

T.VANTREESE. INST.MATL.LAB, U.K.

Lesson 4

FERTILIZING THE CORN CROP

Objective -- To develop the effective ability of the corn producer to plan a fertilization program for the corn crop.

Problem and Analysis -- How should we fertilize our corn crop?

-Using soil tests to determine needs
-Major elements
-Secondary elements and trace elements
-Problems resulting from shortages or excessive nutrients
-When to apply nutrients
-Methods of application

Content

I. Using Soil Tests to Determine Needs

The most common soil test provides information regarding pH, P, and K. More comprehensive tests may be obtained that provide information regarding total exchange capacity (T.E.C.) of the soil organic content, and many of the secondary and trace elements available. All information available should be used along with the cropping program, the ability of the soil to supply moisture, and the erosion hazards of the land in planning the fertilization program.

II. Major Elements

The "big three," nitrogen (N), phosphorus (P), and potassium (K), are the ones that must be supplied in greatest quantities by fertilizers. Corn is a heavy user of N, roughly 2 pounds per bushel of yield found in the roots, stover, and grain. Nitrogen is used by the corn plant early in its life for growth, sturdy stalks, wide leaves with large photosynthesis surface, and later for production of high protein grain. Phosphorus content in the soil and corn plant is low as compared to N and K. Very little of P in the soil is available to the corn crop on a given day, less than 1 pound per acre is in the soil solution to be absorbed. Potassium is required in large amounts and is essential for vigorous growth. All soils (except sand) have large amounts of K but only about 1 to 2% becomes available annually.

III. Secondary and Trace Elements

The elements calcium (Ca), magnesium (Mg), and sulfur (S) are considered secondary elements, since they are used in lesser amounts than the three major elements. Calcium needs to be supplied, by liming, to Kentucky soil since leaching, erosion, and crop removal lowers the pH. Magnesium may need to be supplied to corn grown on soil high in K, low pH, or sandy soils. The simplest method of supplying Mg

is with dolimitic limestone. Sulfur isn't likely to be a problem on Kentucky soils. The trace or micronutrients manganese Mn, Copper Cu, zinc Zn, and boron B are occasionally deficient in corn, but only Zn is likely to be short in our area. For best balance of secondary and trace elements, maintain a pH of 6.0 to 7.0.

IV. Problems Resulting from Shortages or Excessive Nutrients

A deficiency of N shows early in the plant with a pale yellow color, later a V-shaped burn low on tips of blades on the lower portion of plant.

Phosphorus, if deficient, will nearly always appear as a purple coloring and stunted appearance in plants before they reach 24 inches tall. Phosphorus application will increase the supply of available manganese, but if heavy P applications are used, it may cause a zinc deficiency.. Potassium deficiencies are easy to recognize as burns on leaf margins of lower leaves. These symptoms appear anytime from when corn is about a foot tall until before tassels emerge. These deficiencies are inexpensive to correct on the next year's crop, since K is the cheapest of the major nutrients. Low K with high N will cause increased leaf blight, stalk rot, and lodging.

V. When to Apply Nutrients

Fall Nitrogen application is not feasible because of rainfall and warm temperatures. Denitrification (changing nitrates into nitrogen gases N_2O and N_2 which escape into the air) takes place fast when soil temperatures are above 50° F. Most N used by corn must be converted to the nitrate form by nitrification (breaking down urea, manure, plant residue, and anhydrous ammonia into nitrate form), during the growing season. Nitrogen is used throughout the growing season by the corn plant with the greatest use being 3 weeks before tassels emerge. When one bushel of corn will pay for 14 pounds of N applied to the soil, the most profitable amount of N to apply in a continuous corn system will probably be about 1 1/4 pounds for each bushel of grain harvested on deep, dark soils, and 1 1/2 pounds on lighter, drier soil. The remainder of the N may be supplied by plant residue (1 ton corn residue contains 20 pounds N). The phosphorus and potassium needs of the corn crop may be applied in the fall, since neither of them leaches. Only about 15 to 20% of the P applied is available for use by the crop the first year, the remainder is tied up with other minerals and in the reserve for later years. To have P available for greatest recovery, it should be banded alongside the seed rows, since it moves only about 1 to 1 1/2 inches from the point where it was applied. Also, the pH should be between 6.0 and 7.0 for the greatest availability of P. On soils low in P, the use of highly water-soluble forms is beneficial. Potassium for the corn

crop may all be applied in the fall or spring before planting, since it doesn't leach or become tied up with other elements in the soil. The corn plant needs K from planting until grain is produced, with the greatest needs being 3 weeks before tassels emerge.

VI. Methods of Application

Fall applications of P and K, plowed down, work well in Kentucky. Broadcasting of N, P, and K is recommended for land which you own or lease for a long term that has a high fertility level. Row applications of part of the fertilizer are recommended on rented land or land that is low in fertility. Row fertilizer has advantages - faster early growth, more uniform growth on low fertility land, or wet cool land, and may hasten maturity. In row application, keep N and K 1-1/2 to 2 inches away from seed to reduce danger of germination damage. For row applications use 5-10 pounds N, 18-27 pounds P_2O_5 and 12-24 pounds K_2O per acre. Pop up (placing with seed) fertilizer has little added advantage in early start over banding application.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things for the teacher to bring out:

1. The information contained in a soil test and the value of this information.
2. The nutrients needed by corn and how they are supplied.
3. The amount of nutrients needed to produce various levels of production.
4. How and when nutrients may be applied.
5. The amount of fertilizer a farmer can economically apply.

B. Things to get from class members:

1. What their rate of fertilization is per acre.
2. How much per acre they spend on plant food.
3. Types of fertilizer materials used.
4. Methods by which plant food is applied.
5. What plant-food shortage symptoms they have observed.

II. Conclusions

A. Soil test should be made on land to determine the plant food to apply. With the increased use of acid-forming fertilizer materials, the pH level of the soil needs to be checked often.

B. There are 16 elements needed by plants for growth. Three of the elements - oxygen, hydrogen, and carbon - are supplied by air and water. Nitrogen, phosphorus, and potassium are the three major elements that are supplied by fertilizers. Lime supplies the calcium needs, and some lime also supplies magnesium. The other elements are rarely lacking in the soil since they are used in small quantities and most soils contain sufficient amounts.

C. Most crops should have a fertility program planned to provide the necessary plant nutrients in the correct amounts.

D. The phosphorus and potassium may be broadcast and plowed under in the fall or spring. Nitrogen must be applied in the spring to prevent losses from leaching. Row application of fertilizer is usually beneficial on rented land, low fertility land, and land that is wet and cold.

III. Enrichment Activities

A. Make a chart of the amounts of various plant nutrients needed for 100 bushels per acre yield.

B. Plan a fertilizer program and compute the costs of the fertilizer program.

C. Have a demonstration plot to show different rates of fertilization.

D. Have an enlarged chart of a soil test showing results and discuss the information given on the test.

E. Have pictures, slides, or colored drawing of the symptoms in corn of nutrient deficiencies.

IV. Suggested Teaching Materials

A. References

1. Modern Corn Production, Aldrich and Leng, pp.85-167.
2. Advances in Corn Production: Principles and Practices, Pierre, Aldrich, and Martin, pp. 195-329.
3. Soils and Crops, 12th Ed., Successful Farming Book, pp. 97-107.
4. Micronutrients, Swift Agr. Chemicals Corp.
5. Illinois Agronomy Handbook 1971, Cir.1027, pp. 4-9.
6. Corn Growers Guide, P.A.G. Division, pp. 34-48.

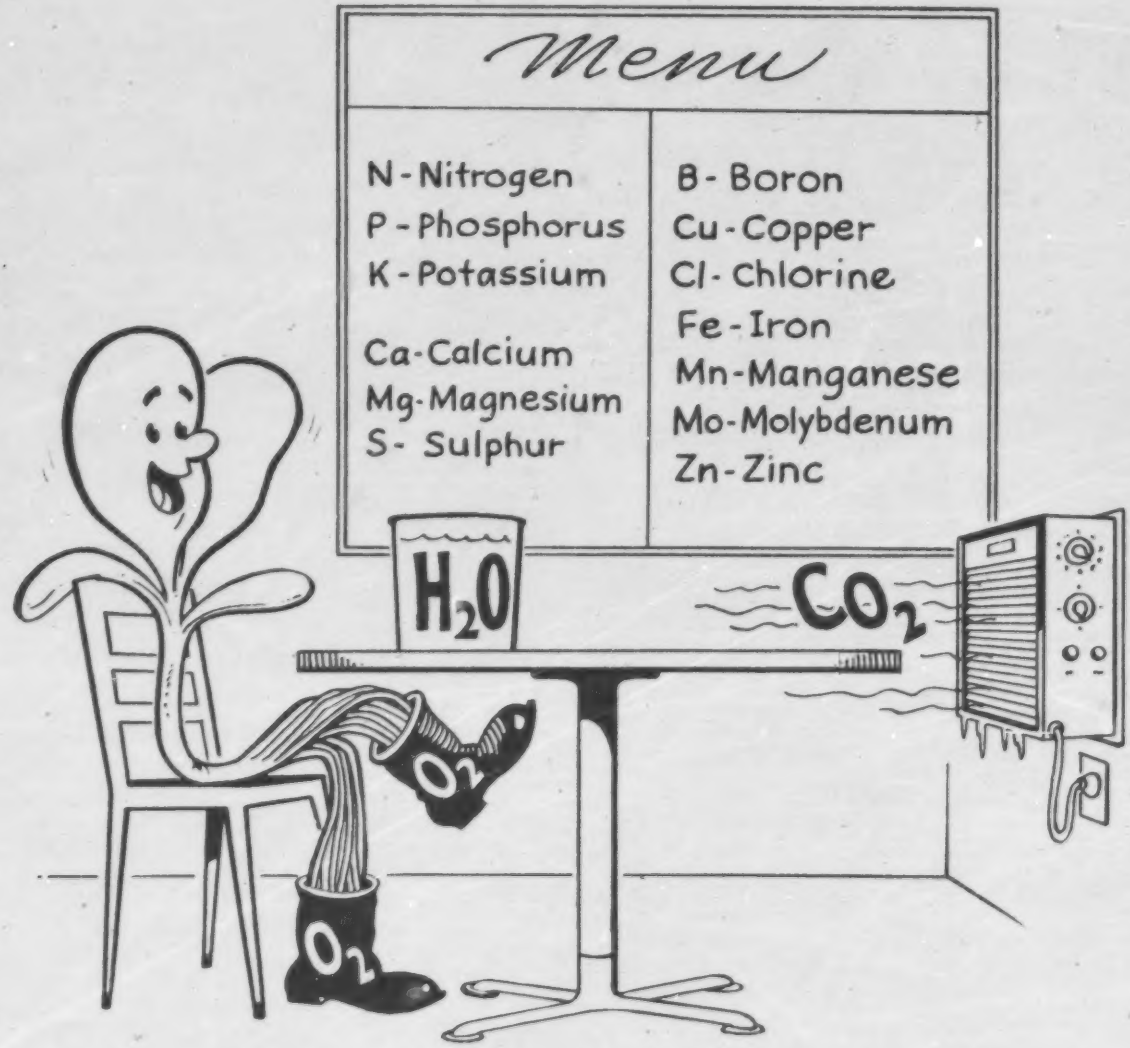
7. A Reference Unit on Corn, Mississippi State U., pp. 66-81.
8. In Illinois Packet, Corn Production:
   Producing High Corn Yields VAS 4039a
   Hunger Signs in Crops VAS 4011a
   Planning the Nitrogen Program VAS 4009a
   Where Do We Stand on Micronutrients in Illinois? by Aldrich

B. Audio-visuals
   1. Masters
      -1 Elements Essential for Plant Growth
      -2 Nitrogen in the Life of the Corn Plant
      -3 Phosphorus in the Life of the Corn Plant
      -4 Potassium in the Life of the Corn Plant
      -5 Availability of Nutrients at Different pH Levels
      -6 Nutrient Needs of Corn

30

PLANTS DINE AT

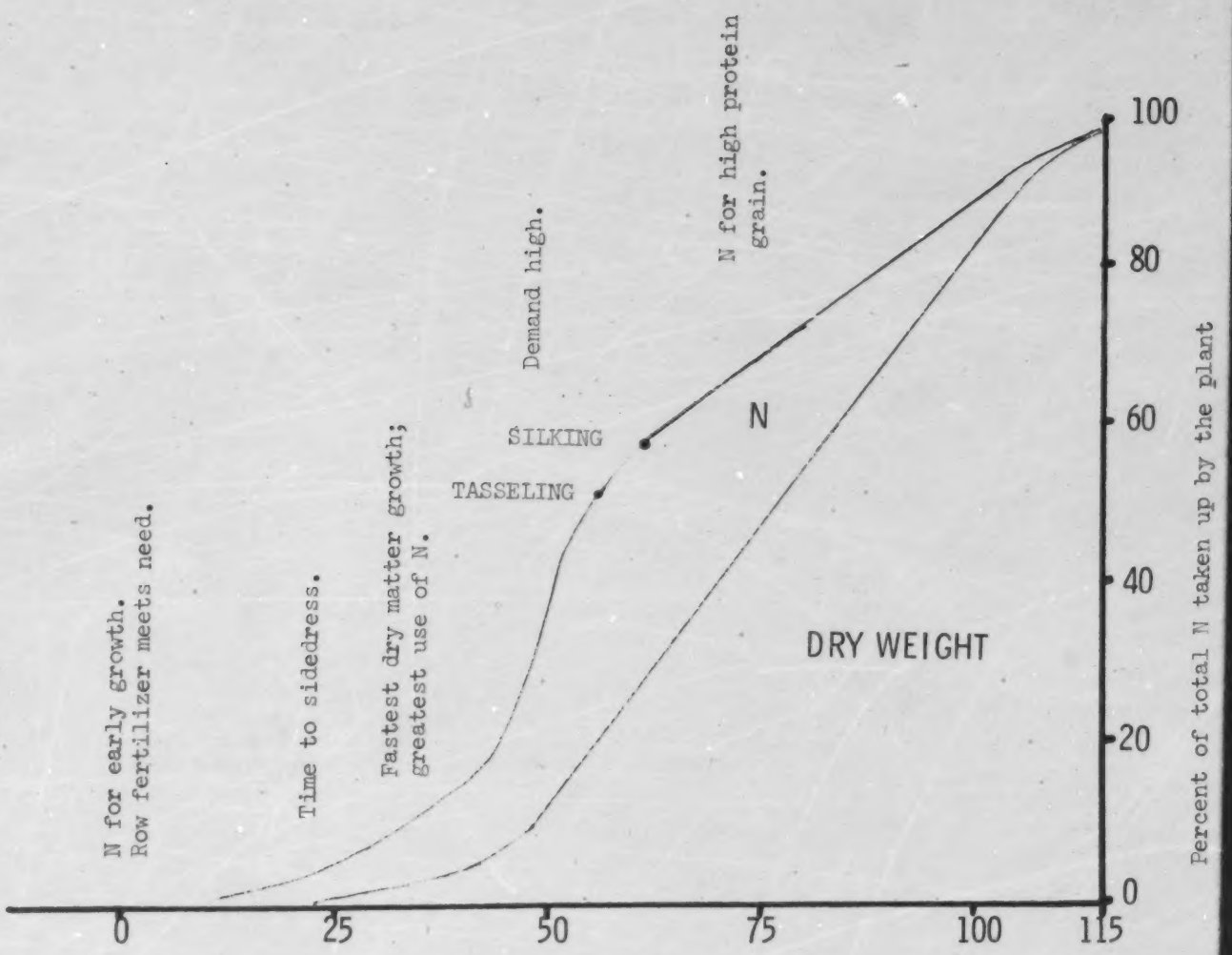
C HOPKNS CaFe Mg



VANTREESE, INST. MATL. LAB., U.K.

107-4-1

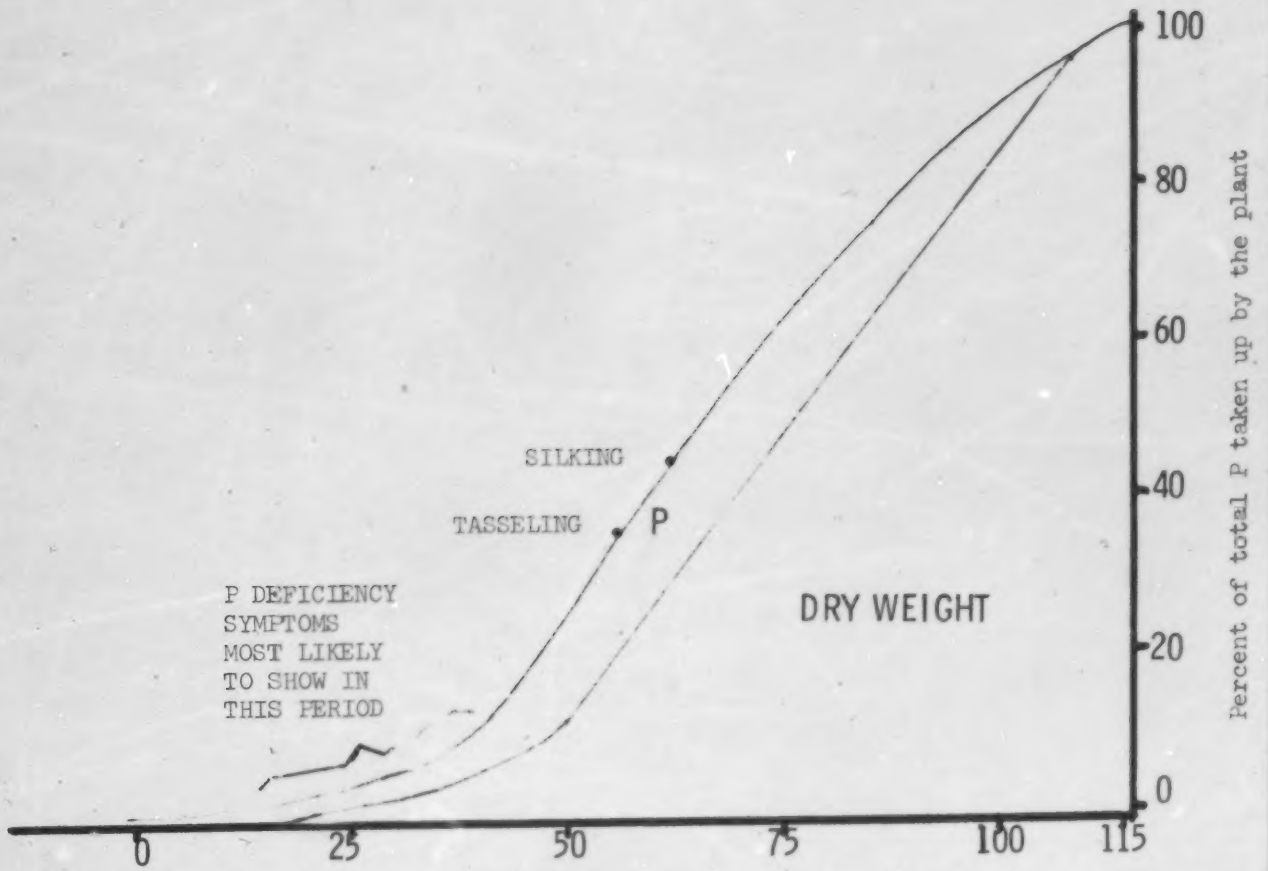
NITROGEN IN THE LIFE OF THE CORN PLANT*



*There are roughly 2 lbs. of N per bushel of yield in the roots, stover and grain.

Source: Adapted from Modern Corn Production, p. 97, Crop Maturity (Days).

PHOSPHORUS IN THE LIFE OF THE CORN PLANT

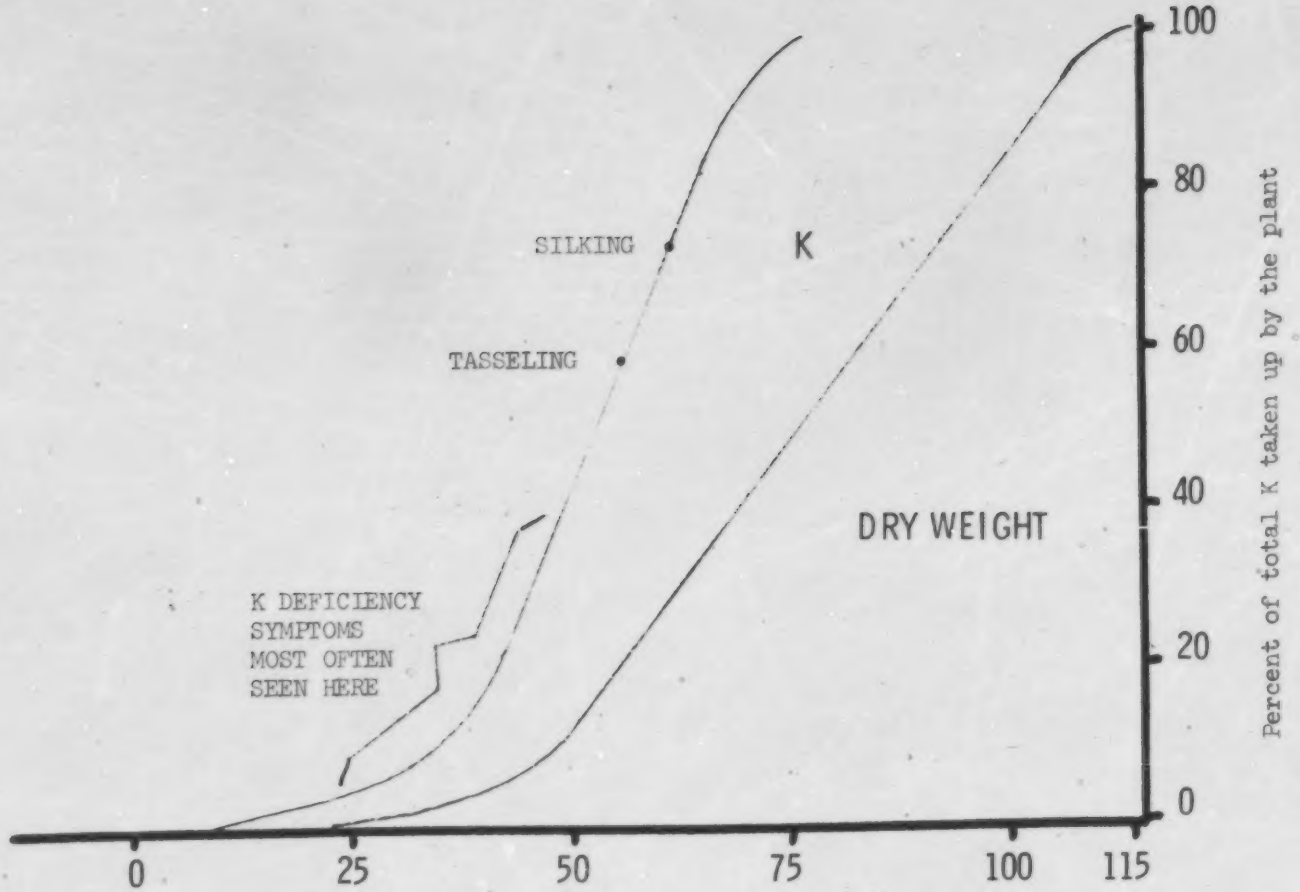


Note: Phosphorus is taken up throughout the life of the corn plant, but the most critical period is early in the season. At that time, the capacity of the root system to obtain phosphorus is low. The reddish-purple deficiency symptoms rarely show after corn is 24 to 30 in. tall.

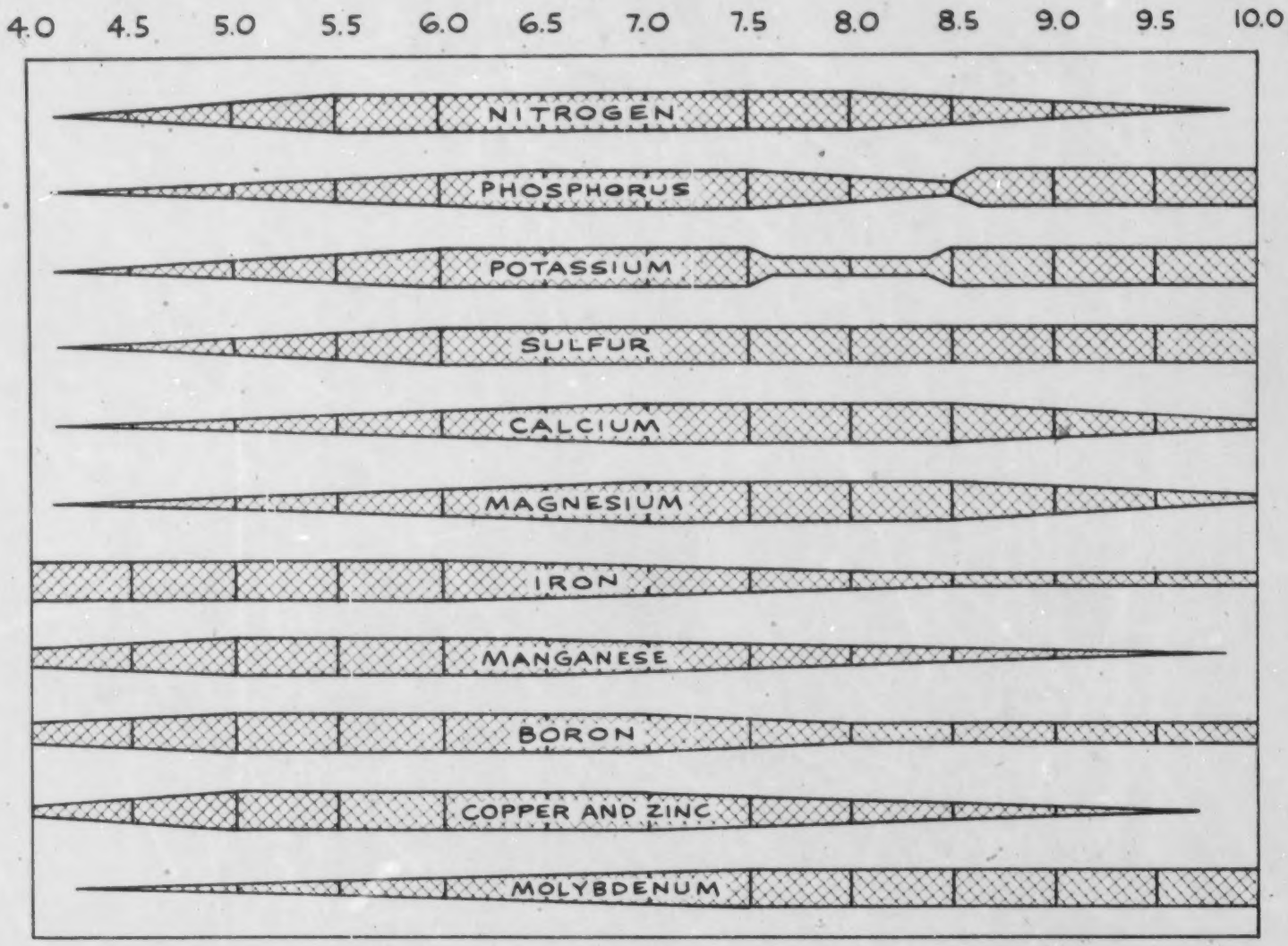
Source: Adapted from Modern Corn Production, p. 115, Crop Maturity (Days).

107-4-5

POTASSIUM IN THE LIFE OF THE CORN PLANT



Source: Adapted from Modern Corn Production, p. 121, Crop Maturity (Days).



SOIL ACIDITY AFFECTS THE AVAILABILITY OF MOST NUTRIENT ELEMENTS

T. WAUTRECESE, INST. MATL. LAB., U.K.

107-4-5

POUNDS OF SELECTED PLANT NUTRIENTS CONTAINED IN CROPS

CROP	NUTRIENT										
	N	P_2O_5	P	K_2O	K	Ca	Mg	S	Cu	Mn	Zn
Corn, 100 bu.											
grain	90	36	16	26	22	11	13	10	.04	.06	.10
stover	67	24	11	98	80	18	12	7	.03	1.00	.20
Total	157	60	27	124	102	29	25	17	.07	1.06	.30

Source: Our Land and Its Care, National Plant Food Institute, 1962.

107-4-6

Lesson 5

PRODUCING CORN BY REDUCED TILLAGE METHODS

Objective -- To develop the effective ability of farmers to produce corn by use of reduced tillage methods.

Problem and Analysis -- Should we use a reduced tillage method in producing corn?

-Reasons for Tillage
-Definition of minimum tillage and no-tillage
-Types of minimum tillage
-Advantages of no-tillage
-Management practices
-Developments leading to no-tillage
-Double cropping systems

Content

I. Reasons for Soil Tillage

A. Gets seed into ground and covered for good germination.
B. Controls weeds.
C. Makes for easier harvesting.
D. Tradition

II. Definition

The definition of minimum tillage varies according to the purposes of tillage, or the amount of tillage operations performed; but it can be described as reducing the tillage only to those operations that are essential and timely in producing the crop. No-tillage (a method of minimum tillage) is a term often used today in agriculture circles. No-tillage is the planting of crops in soil that has not had any previous preparation, by placing the seed in a narrow trench, or slot, or band only wide and deep enough to obtain good seed coverage. Other terms used for no-tillage are: zero tillage, no-plow tillage, no-till, sod planting, direct seeding, and direct planting.

III. Types of Minimum Tillage

A. Plow-plant, in one operation.
B. Plowing and planting in two operations.
C. Wheeltrack planting in plowed, or plowed and harrowed soil.
D. Strip-till planting.
E. Stubble-mulch planting.
F. Lister planting.

G. Chisel-plow planting.
H. Field-cultivator planting.
I. Disk-plant.
J. No-tillage.

IV. Advantages of No-Tillage
No-tillage production of corn has several advantages that should be encouraging for farmers: use of steeper land, better utilization of soil moisture with reduced runoff, reduced machinery inventory, reduced labor needs, less erosion problem , less soil damage from machinery, planting when wet, reduction of some weather risks, higher yields under drier conditions, and reduced double-cropping risks.

V. Management Protection and Problems to Consider in Using No-Tillage.
With no-tillage method of corn production, there are several management practices that must be given special consideration:

A. Fertilization application - timing, placement, method.
B. Soil selection - type.
C. Weed and insect control.
D. Rodent control.
E. Variety selection.
F. Time of planting.
G. Crop rotations best suited to the tillage system.
H. Most economic machine and power balance.

VI. Developments Leading to No-Tillage
Several developments during the 1960's have brought about increased interest in no-tillage method of planting. Those developments which have had the greatest influence are:

A. Development of effective herbicides.
B. An increased emphasis on soil conservation.
C. Machinery being developed that will do a desirable job.
D. Less labor being available to the farmer.
E. Need for increased farm production volume.
F. Need for using erodable land for row crop production
G. Lower prices received by farmers for farm products.
H. Higher land prices and unavailability for purchase.
I. Need to reduce the amount of capital invested in machinery.

VII. Double-Cropping Systems
With the no-tillage system of corn production, there are several methods of developing a cropping program. Corn may be grown continuously in a no-till program, but growing the same crop continuously may present a serious problem after a few years of insects and weeds. More no-tillage corn is produced by a double-cropping system (2 crops in 1 year or 3 crops in 2 years) such as: corn/small grain for silage, small grains/corn silage, corn/barley for grain, corn/barley/soybeans (2 year program), corn/wheat/soybeans (2-year program), and corn/wheat/grain sorghum (2 year program). In the no-tillage method of planting, the corn may be planted after various types of crops: killed sod, killed small grain cover crop, stunted sod, soybean residue, small grain stubble, grain sorghum residue, corn residue, and various other crop[illegible]

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. What is meant by minimum tillage and no-tillage.
2. Kinds of minimum tillage being carried out in community.
3. The advantages of producing corn by no-tillage.
4. Problems that can develop in no-tillage method.
5. Why there has been an increase in no-tillage method.
6. Different types of cropping systems with no-tillage.

B. Things to get from class members:
1. How many are using or have used a minimum tillage method of corn production.
2. The results they obtained using minimum tillage.
3. Major problems they have had with minimum tillage.
4. Herbicides and insecticides they use and results.
5. What their cropping system is with no-tillage method.
6. Differences in cost of production with no-tillage vs. conventional tillage.

II. Conclusions

A. Minimum tillage planting of corn has become a proven successful method of planting corn.

B. There are several types of minimum tillage for producing corn. The type you should use should be determined by the machinery you have, soil type, and cropping program.

C. No-tillage production of corn results in better land usage of soil by reducing soil compaction by machinery, better moisture retention, reduced rainfall runoff, and less erosion, reduced cost of production, reduction in amount of machinery needed, plus other advantages.

D. No-tillage corn production requires good management practices being followed. With no-tillage production, there is less opportunity to correct mistakes, especially in weed and insect control.

E. More corn will be grown in the future by the no-tillage method because of farmers' acceptance, because of the research being done, and because of the experience and knowledge that has been gained in no-tillage.

F. The returns per acre have increased on many Kentucky farms as a result of double cropping. The cropping program practiced on many farms is a two-year program of corn followed by small grains, then soybeans.

III. Enrichment Activities

A. Conduct a farm tour to observe the different types of minimum tillage being done in the community.

B. Use a panel of farmers to discuss their methods of minimum tillage.

C. Have containers of herbicides and insecticides recommended for no-tillage use to display before class.

D. Visit machinery dealers to view different kinds of no-tillage planters, or have representatives from machinery dealers to discuss their no-tillage planters.

IV. Suggested Teaching Materials

A. References

1. No-Tillage Farming, Phillips and Young, pp. 20-76, 87-101, 117-200, 203-211.
2. Modern Corn Production, Aldrich and Leng, pp. 57-64.
3. Corn Growers' Guide, P.A.G. Division, pp. 27-30.
4. Crops 72, The Farm Quarterly, pp. 22-23.
5. Illinois Agronomy Handbook, 1971, Cir. 1027, pp. 45-47.
6. No-Tillage Systems for Grain Production, Leaflet 310, U. of K.

B. Audio-visuals

1. Masters
   -1 Cost Comparisons of Conventional vs. No-Tillage Methods
   -2 Moisture Retention by No-Tillage
   -3 Methods of Minimum Tillage

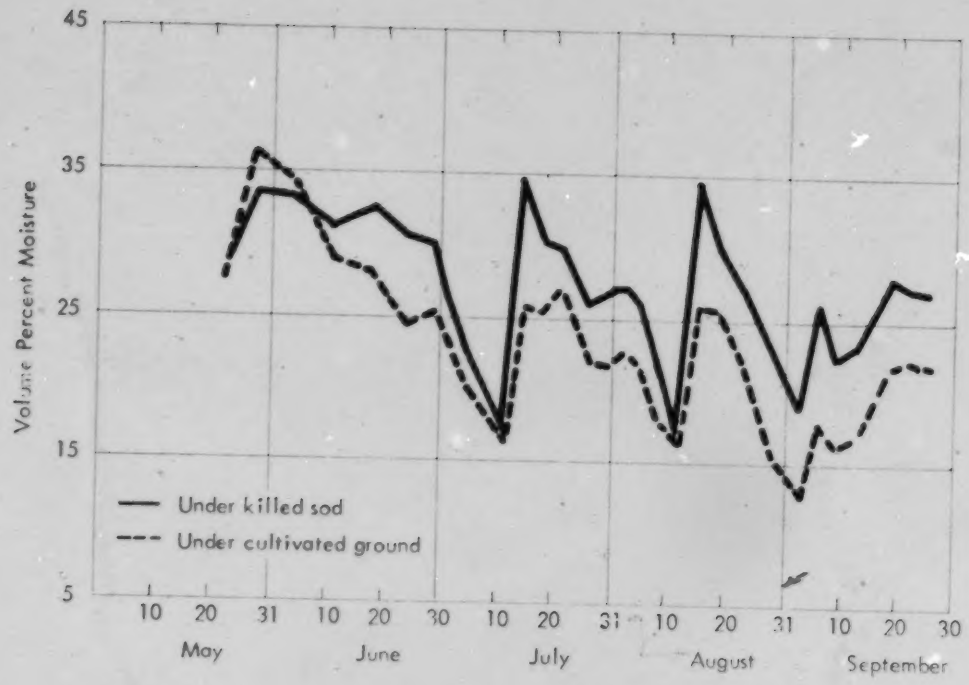
COST COMPARISONS OF CONVENTIONAL VS. NO-TILLAGE METHODS

Tillage Method	Equipment Investment	Total Costs Per Acre	Cost Savings Compared to Conventional Tillage
Conventional	$36,000	$23.00	-
Chisel Plow Planting	42,000	21.50	$1.50
Plow Planting	31,000	20.50	2.50
Rotary Tillage Planting	32,000	20.50	2.50
Wheeltrack Planting	29,000	20.50	2.50
Field Cultivator Planting	32,000	20.00	3.00
Strip Till Planting	28,000	19.50	3.50
No-Tillage Planting	28,000	19.00	4.00

SOURCE: Adapted from No-Till Farming, p. 124.

107-5-1

MOISTURE RETENTION BY NO-TILLAGE PLANTING
WOODFORD CO., 1968



SOURCE: No Tillage, Ky. Progress Report 187, p. 6.

METHODS OF MINIMUM TILLAGE

Plow-plant, in one operation.

Plowing and planting in two operations.

Wheeltrack planting in plowed, or plowed and harrowed soil.

Strip-till planting.

Stubble mulch planting.

Lister planting.

Chisel plow planting.

Field-cultivator planting.

Disk-plant.

No-tillage.

SOURCE: No-Tillage Farming

107-5-3

Lesson 6

PLANTING THE CORN CROP

Objective -- To develop the effective ability of farmers to plant corn.

Problem and Analysis -- How should we plant corn to get optimum yields?

-Seedbed preparation
-Planting date
-Depth of planting
-Plant population
-Row width
-Calibrating the planter

Content

I. Seedbed Preparation

Several methods are now used, from conventional to no-till. The no-till method has been discussed in Lesson 5. Fall plowing is the practice in many Kentucky counties where land is so level that erosion isn't a problem. Fall plowing helps to destroy insects that over-winter in the stalks, and also, fall plowing increases decomposition of residue before the corn crop is planted. If land plowed in the spring has a cover crop on it, 30 pounds of N per acre should be turned under with the cover crop to speed decomposition of the residue. Implements mostly being used for primary tillage (breaking up of the soil) are the mold-board plow, disk plow, chisel plow, and disk harrow. On land where there is danger of erosion, the chisel plow will leave residue on top of the surface that will help reduce erosion. The disk narrow is being used more in recent years on soil that has good tilth and weeds are not a serious problem. Secondary tillage (all soil preparation between primary tillage and planting) should accomplish one or more of the following: pack the seedbed, loosen the seedbed, break clods, cut trash or sod, kill weeds, or smooth the seedbed. The important things in seedbed preparation are to destroy weeds, and to pulverize so the planter can put the seed in contact with moist soil.

II. Planting Date

A. In recent years early planting has become a common practice in Kentucky. Early planting has shown that the corn develops better and therefore has higher yield potential when its vegetative period falls in the cooler, more moist weather of May and early June. The nearer June 22nd you can get tasselling, pollination, and ear filling during this period of long daylight hours, the greater possibility of higher yields. Early

planting also results in deeper root system, shorter stalks, and lower ear height with less lodging and less insect damage.

B. The planting date will depend on soil temperature and moisture. Planting ten days to two weeks after killing frost would be a good guide if it were possible to know exactly when this would occur. If corn is planted and has come up, and a frost occurs, it usually will not do permanent damage if the growing tip still is below ground. A better guide for planting is the soil temperature -- it must be 50° to sprout and should be 60° for corn to germinate in 7 to 10 days. Late planting results in reduced yields. Planting after May 15 results in a daily reduction of one-half bushel per acre; each day after May 25 until June 5 will reduce the yield one bushel per acre; and after June 5 you will lose two bushels per acre per day.

C. A method of planting called "Calendarization" is being used by many farmers. "Calendarization" is planting part of the crop in early variety(ies), part in midseason variety(ies), and part in full season variety(ies) -- starting with the early first and finishing with the full season last. "Calendarization" planting spreads out time of harvest over the optimum period; reduces risk of entire crop being damaged by drought, insects, or disease; and gives more time to plant small grains or do fall plowing.

III. Depth of Planting

This depends on the soil, geographical conditions, varying temperatures, and the soil moisture. Under optimum conditions, 2" deep is ideal, but early planting should be 1/2" to 1" shallower than this. On dry, clay soil planting should be 3" to 3 1/2" deep, and on dry, silt soils up to 3 3/4" deep. Always plant only deep enough to provide fast germination. Planting deep has no effect on the development of the root system since the roots develop on the nodes located just under the surface of the soil.

IV. Plant Population

The population should be based upon soil fertility. Ear size is a guide for plant population. One-half pound ears are ideal--heavier ears indicate too low population, and lighter ears than one-half pound indicate too high population or limited fertility. The most common range of population for Kentucky is 14,000 to 22,000 plants per acre. It requires a population of 14,000 plants with one-half pound ears to produce 100 bushels per acre. When determining desired final plant population, plant 10 to 15% additional (2,000 to 3,000 more) kernels because, in high populations,

seedling mortality is a little greater, plants are shorter and they lodge less, and moisture is more likely to be adequate. In many varieties of hybrids, lodging increases with high population.

V. Row Width

A. Base the decision to use narrow rows upon these factors:

-Do corn yields now average well over 100 bushels per acre?
-Can the shift in row spacing be made at a reasonable cost?
-Weeds and insect control may present different problems.
-More attention must be given to selecting varieties.
-Do you grow more than 100 acres of soybeans? (Equipment versatility)
-Are you a good crop manager?
-Plant population exceeds 20,000.

B. A 5% average increase for 36" rows over 40" can be expected. Do all other practices (fertilization, variety selection, land preparation, population, weed and insect control, early planting) to increase yields, then switch to narrow rows.

VI. Calibrating the Planter.

To insure the correct plant population, the planter should be calibrated to be sure the desired drop is being obtained. The following things should be done in calibrating the planter:

Read owner manual.
Determine field speed.
Match seed to seed plate.
Adjust planter for desired planting rate.
Calibrate in barnlot or roadway before planting.
Make a field check.
Count emerged plants and final harvest population.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Reasons and methods for seedbed preparation.
2. Influence of planting date on yield and lodging.
3. Ways of determining plant population.
4. Yields to be expected from various populations.
5. Expected costs of changing to narrow-row equipment.
6. Steps in calibrating corn planter.

B. Things to be obtained from class members:
   1. Different methods of seedbed practices used.
   2. Results obtained in these methods of preparation.
   3. Date most begin planting and date they set to be finished, and differences they have experienced in yields between early and later planting.
   4. Plant population they are using, and reasons.

II. Conclusions

A. Provide a seedbed that will be free of weeds and put the corn kernel in contact with moist soil.

B. Start planting early as possible, in early April, and try to finish by May 15 if possible.

C. Under ideal conditions plant 2" deep, early planting 1" to 1 1/2", and if dry 3" to 4 1/2", depending on soil texture.

D. Determine the plant population by the soil fertility. Plant the optimum population to give the highest yields and use the inputs to the best advantage.

E. Plan to grow narrow rows if large number of acres of soybeans are grown; machinery you now use is in need of replacement; you are doing top job with all the other factors in producing high yields.

F. Calibrate corn planter to insure you obtain the desired plant population.

III. Enrichment Activities

A. Visit farms to view different tillage methods.

B. Use flats for classroom demonstrations on planting depth to demonstrate the effect on germination with different soil texture, moisture, and temperature.

C. Check plant population on members' farms.

D. Calibrate a corn planter on a member's farm.

IV. Suggested Teaching Materials

A. References

1. Modern Corn Production, by Aldrich and Leng, pp. 41-57, 67-83.
2. Corn Growers' Guide, P-A-G Division, pp. 4-24, 31-32.
3. Profitable Corn Production, Iowa State U., Pm-409, pp. 4-6.
4. Rate of Planting Corn, Ohio State U., Dept. of Agr. Edu., AGDEX 111/22.
5. A Reference Unit on Corn, by Beeman, Mississippi State U., Agr. Edu. Dept., pp. 51-65.
6. Producing High Corn Yields, Illinois VAS 4039a, pp. 1-6.
7. Soils and Crops, 12th Ed., Successful Farming book, pp. 23-27, 30-31.
8. Growing Corn, U.S.D.A. Farmers Bulletin 2225, pp. 1-5.
9. Growing Corn in Kentucky, Cir. 588-A, pp. 5-7.
10. Economics of Narrow-Row Culture, Illinois paper no. 65-654.

B. Audio-visuals

1. Masters
   - -1 Effects of Planting Date
   - -2 Expected Yields from Given Plant Populations
   - -3 Spacing Between Seeds at Various Plant Populations and Row Widths
   - -4 Effect on Barren Stalks by Population
   - -5 Corn Planting Speed and Its Effect on Seed Drop
   - -6 Calibrating Kernel Drop
   - -7 Rate of Planting Guide

2. Slidefilm
   "Planting Corn," VAS 731, Illinois.

3. Film
   "High Profit Trio," The Venard Organization.

EFFECT OF CORN PLANTING DATE ON YIELD*

Planting Date	Yield Bu Per Acre	Percent Lodging
April 25	95	8
May 12	91	8
May 25	81	10
June 8	74	14

*A 16,000-stalk population was used in the tests.

SOURCE: Growing Corn in Kentucky, Ky. Circular 588, p. 6.

EXPECTED YIELDS FROM GIVEN PLANT POPULATIONS

Population	Yield Bu./A.	Percent Lodging (Picker Loss)
8,000	73	5
12,000	88	7
16,000	91	8
18,000	97	9.8
22,900	95	13.8

Adapted from: Ky. Circular 588-A and Modern Corn Production, p. 70.

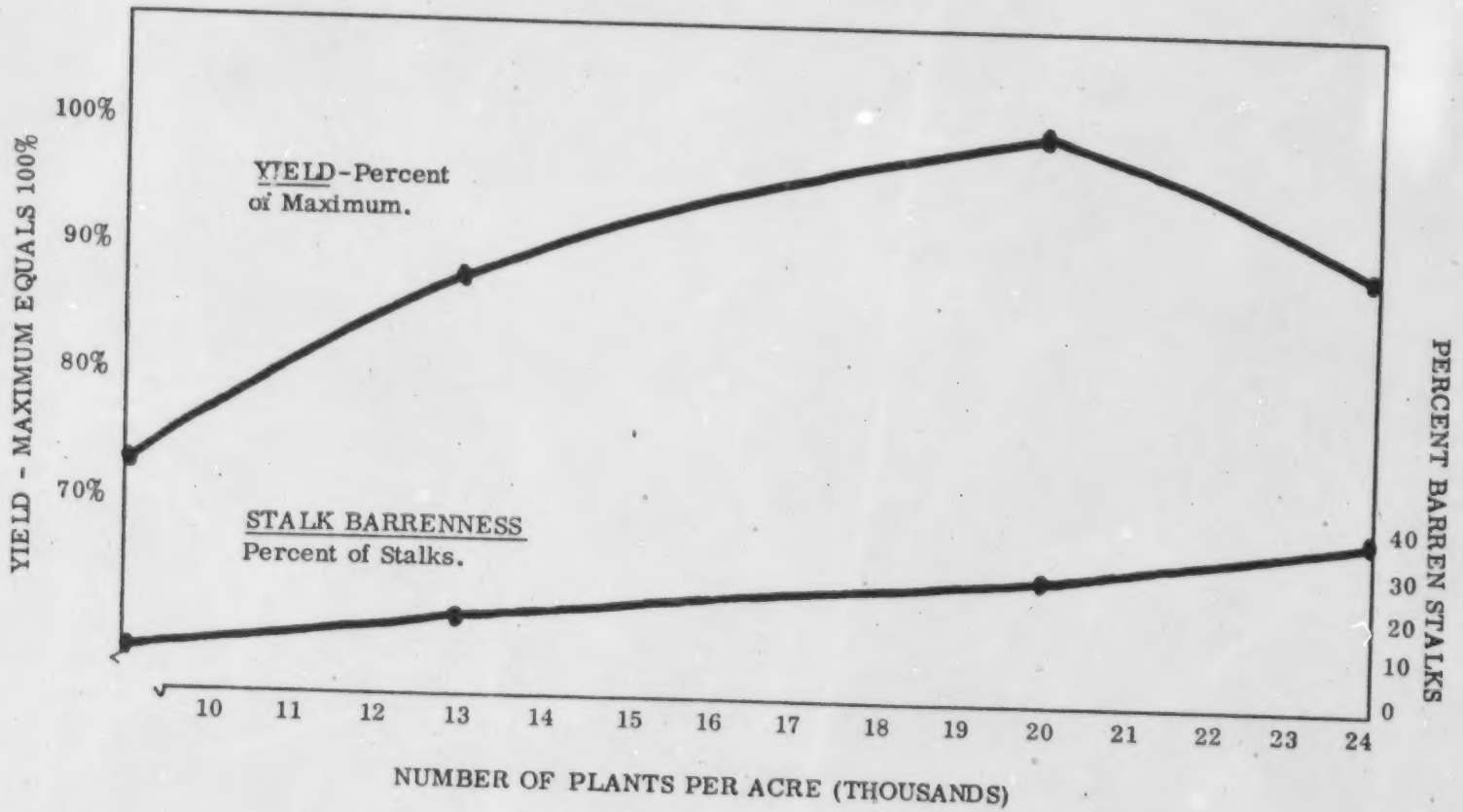
107-6-2

SPACING BETWEEN SEEDS AT VARIOUS PLANT POPULATIONS AND ROW WIDTHS

Rates of Planting Kernels per acre	Estimated Stand Allowing 15% Stand Loss	Spacing in Row (inches)			
		Row Widths			
		36"	38"	40"	42"
20,000	17,000	8.7	8.2	7.8	7.5
21,000	17,850	8.3	7.8	7.4	7.1
22,000	18,700	7.9	7.5	7.1	6.8
23,000	19,550	7.5	7.2	6.8	6.5
24,000	20,400	7.2	6.8	6.5	6.2
25,000	21,250	6.9	6.6	6.3	5.9

SOURCE: Rate of Planting Corn, Ohio Vocational Agriculture Service, p. 9

THE NUMBER OF BARREN STALKS INCREASES AS PLANT POPULATION INCREASES

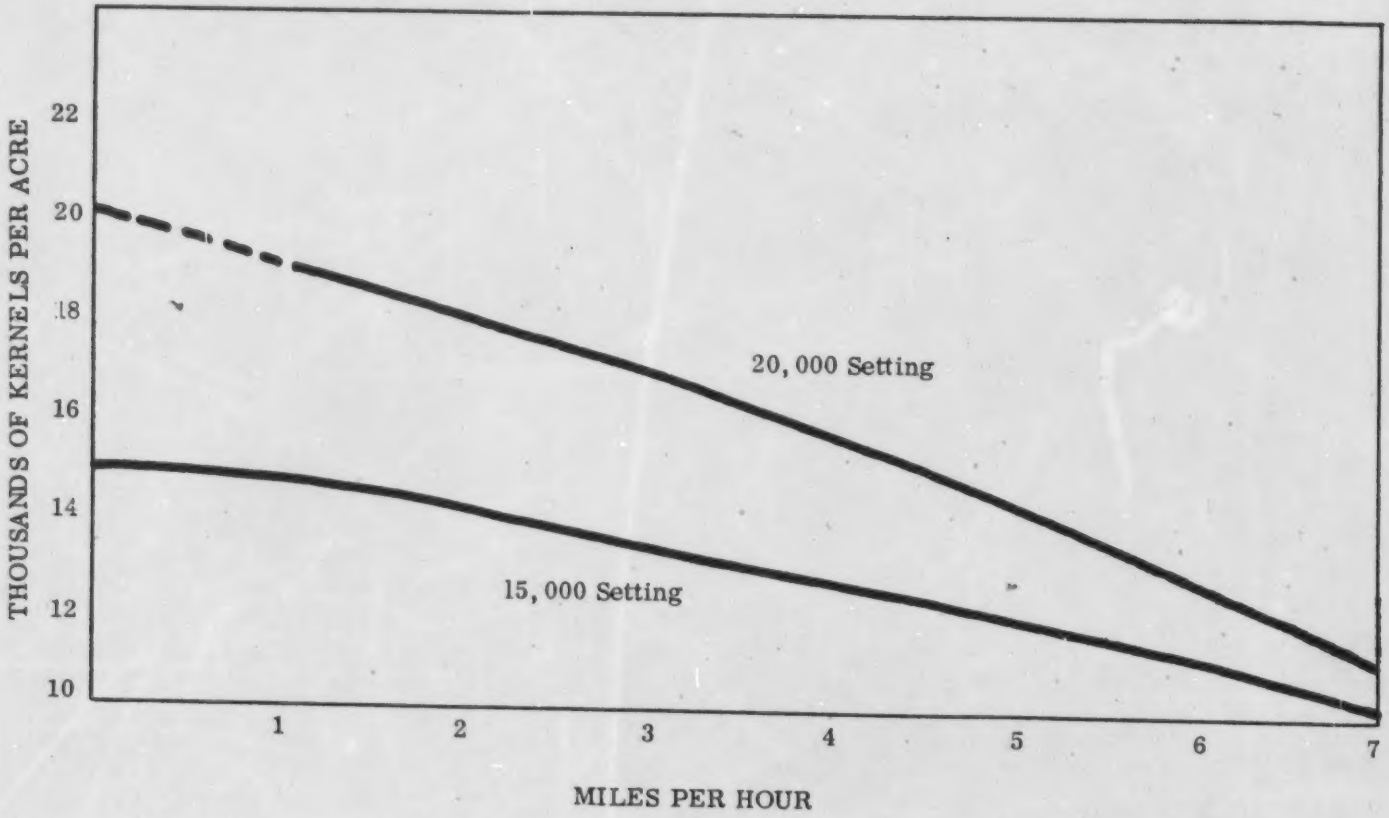


SOURCE: Rate of Planting Corn, Ohio Vocational Agriculture Service, p. 8.

CORN PLANTING SPEED AND ITS EFFECT ON SEED DROP

Planter setting: 15,000 and 20,000 seed drop

Seed plate: $\frac{36}{64}$" length seed cell



SOURCE: Rate of Planting Corn, Ohio Vocational Agriculture Service, p. 24

107-6-5

CALIBRATING KERNEL DROP

1. Check planter parts -- replace worn parts and clean all parts.
2. Select proper plant population.
3. Read the operators manual.
4. Match corn seed grade to plate size.
5. Adjust planter for desired planting rate.
6. Check seed drop on clean, flat surface
   - -Stake out distance
   - -Drive at planting speed
   - -Count kernels from back row
7. Make a field check (dig into row)
8. Count emerged plants and plants ar harvest time.

Rate of Planting Guide

DRILLED CORN	Inches between rows			
Spacing in rows	42"	40"	38"	36"
	Plants per acre			
6"	21,100	22,200	23,400	24,400
8"	15,900	16,700	17,500	18,300
10"	12,700	13,300	14,000	14,700
12"	10,600	11,100	11,700	12,200
14"	9,100	9,500	10,000	10,500

HILL DROPPED CORN		Inches between rows			
Spacing between hill	Kernels per hill	42"	40"	38"	36"
		Plants per acre			
16"	2	15,800	16,700	17,500	18,300
20"	2	12,700	13,300	14,000	14,700
	3	19,000	20,000	21,000	22,000
24"	2	10,600	11,100	11,700	12,200
	3	15,900	16,700	17,500	18,300
28"	2	9,000	9,500	10,000	10,500
	3	13,600	14,300	15,000	15,700
	4	18,100	19,000	20,000	20,900

CHECKED CORN	Inches between rows			
Kernels per hill	42x42	40x40	38x38	36x36
	Plants per acre			
1	3,000	3,300	3,700	4,100
2	6,000	6,700	7,400	8,200
3	9,100	10,000	11,100	12,300
4	12,100	13,300	14,800	16,500
5	15,100	16,700	18,400	20,600

NOTE: The numbers of plants per acre have been adjusted to account for an average of 15 percent loss due to germination, cultivation, etc.

(Area enclosed by shaded lines denotes more common or usable row widths.)

Source: Kentucky Curricular 588-A, p. 8.

Lesson 7

CONTROLLING WEEDS IN CORN

Objective -- To develop the effective ability to control weeds in corn.

Problem and Analysis -- How can we control weeds in corn?

-Why control weeds
-Weeds most commonly found in Kentucky corn fields
-Methods of controlling weeds
-Using herbicides to control weeds
-Factors to consider when using herbicides
-Reducing herbicide residue
-Calibrating the sprayer

Content

I. Why Control Weeds

Weeds should be controlled in corn because they:

A. Result in repeated, expensive cultivations
B. Make harvesting difficult and costly
C. Compete with the corn plant for use of labor and equipment
D. Reduce rate of maturity of corn
E. Use plant food, moisture, and sunlight needed by corn plants
F. Reduce corn yields, therefore reducing net returns

II. Weeds Most Commonly Found in Kentucky Corn Fields

Weeds which are problems in Kentucky corn fields are: pigweed, lambsquarter, cocklebur, smartweed, common morning glory, common ragweed, giant ragweed, jimsonweed, curly dock, common milkweed, field bindweed, crabgrass, foxtail, fall panicum, Johnson grass, nutgrass, barnyard grass, wild cane, goosegrass, Bermuda grass, and velvetleaf. Weeds are either broadleaf or grass (blade) and these broadleaf or grasses are either annuals (grow from seeds) or perennials (develop from rootstock year after year).

III. Methods of Controlling Weeds

With some of the current farming practices being used in corn production, weeds tend to be a greater problem. Early planting, less cultivation, higher fertilization, and continuous corn all contribute to weed problems becoming greater. Crop rotations are helpful in breaking cycle of weeds. Cultivation with a rotary hoe, spike-tooth harrow, spring-tooth weeder, or cultivator have been the only way of controlling weeds in corn until the development of herbicides. Herbicides are the common method of weed control in corn on most of our present-day farms. Cultivation is still used where good weed control is not obtained with herbicides and where the soil has formed a thick, hard crust.

IV. Using Herbicides to Control Weeds

Presently there are several herbicides on the market for the control of weeds in corn. Some of the herbicides are very effective on broadleaf weeds, others on grasses, and some are effective on both broadleaf and grass. Many of these herbicides were developed for use as pre-emergence (before corn plant comes up) application, and some may be used both ways. Some of the herbicides must be incorporated into the soil, whereas others may be applied to the top of the soil. With this great variety of differences in herbicides, it is important for the farmer to know what his weed problems are and what method he wishes to take to fight the problems.

V. Factors to Consider when Using Herbicides

There is not a herbicide on the market that can assure 100% weed control every time. Many factors - soil temperature, organic content of soil, soil pH, soil structure, soil moisture, time of application of herbicide, rate of application of herbicide, wind velocity, and rainfall after application - will influence the success of the herbicide or herbicides applied. Some of the herbicides are more soluble than others. The more soluble chemicals require less rainfall to activate, but they are apt to be moved down too far below the weed seed to be effective. The less soluble chemicals have longer-lasting effects, but it requires more rainfall to make them work. Soil differences, new herbicides being developed, some herbicides being taken off the market, and other factors make it necessary for the farmer to obtain up-to-date information from the university experiment station, county extension agent, vocational agriculture teacher, or chemical companies regarding use of herbicides.

VI. Reducing Herbicide Residue

Some chemicals have a long effective life and may have a carryover into the next crop. To prevent this herbicide residue danger, the following practices tend to reduce the carryover: don't apply more of the herbicide than is absolutely necessary; apply long-lasting herbicides in bands over row to keep down rate per acre; if risk of carryover exists, plant same crop next year or one that is non-sensitive; and in changing crops in rotation, use herbicide with little carryover.

VII. Calibrating the Sprayer

To assure that the correct amount of herbicide is being applied, the sprayer should be calibrated. Follow the sprayer manufacturer's recommendations on pressure, nozzle tips, and speed in determining the rate of application. Change nozzle tips when they become worn to the extent they alter the rate of application. With some of the more abrasive herbicides, this may be as often as every 100 acres covered.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Types of weeds (annuals and perennials; broadleaf and grasses).
2. Ways of controlling weeds.
3. Herbicides available and kinds of weeds controlled.
4. Applying herbicides.
5. Cost of different herbicides.
6. What precautions should be followed when applying herbicides.
7. How to calibrate a sprayer.

B. Things to get from the class members:
1. What cultural practices they are now using.
2. The weeds which cause them major problems.
3. What herbicides they are using.
4. Results obtained from the herbicides.
5. Their costs per acre with herbicides they use.
6. Methods they have used in applying herbicides.

II. Conclusions

A. Weeds compete with corn for plant food, water, and sunlight. Weedy corn results in difficult harvest, more labor needed to produce, and reduction in yields.

B. There are many weeds which may present problems in corn. Some of these weeds may be controlled by preventing them from producing seed while others must have the roots destroyed to prevent them from reproducing.

C. Corn producers are fortunate to have many herbicides available for controlling weeds. On most farms, the weed problem may be such that two herbicides are needed to control the problem.

D. Don't expect perfect results every time from herbicides. There are many factors which may interfere with the working of the herbicide. If you do not get good results from the herbicide, don't wait around for a miracle to happen. Use a post-emergence herbicide or cultivate.

E. When using some herbicides, be careful not to get a carry-over residue that may injure the following crop. Use only the recommended rates and follow instructions when using herbicides.

F. Calibrate your sprayer often to be sure you are getting the correct rate of application. Too heavy application may cause crop damage and too light an application will not give the desired control.

III. Enrichment Activities

A. Have available samples of the herbicides used to control weeds in corn. Have price lists for each.

B. Display specimens, mounts, or slides of the weeds which are a problem.

C. Use farmers and representatives of chemical companies as resource persons for this class.

D. Demonstrate the adjustment and calibration of spray equipment on members' farms.

E. Plan demonstration plots comparing different herbicides, different rates of application, and different methods of application.

F. Make pictures (slides) of the results of herbicides used in the community.

IV. Suggested Teaching Materials.

A. References

1. Modern Corn Production, Aldrich and Leng, pp. 195-203.
2. Advances In Corn Production: Principles and Practices, Pierre, Aldrich, and Martin, pp. 331-351.
3. Profitable Corn Production, University of Illinois, pp. 14-15.
4. A Reference Unit On Corn, Mississippi State U., pp. 82-85, 97-98.
5. Soils and Crops, 12th Ed., Successful Farming Book, pp. 55-61, 64-69.
6. Corn Growers Guide, P.A.G. Division, pp. 50-68.
7. Crops 72, The Farm Quarterly, pp. 34-35, 38-39.
8. Chemical companies' publications regarding herbicides.

B. Audio-visuals

1. Masters
   -1A-C Corn Herbicides
   -2 Sprayer Calibration

2. Slidefilms (University of Illinois)
   "Identification of Weeds," Part I VAS 791
   "Identification of Weeds," Part II VAS 792
   "Controlling Giant Foxtail" VAS 794
   "Using Pre-emergence Herbicides" VAS 797
   "Recognizing Herbicide Injury"
   "A Systematic Approach to Weed Control" VAS 799

3. Films
   "Herbicides - Fundamentals of Proper Application,"
   Geigy Agricultural Chemicals

HERBICIDES FOR CORN

Preplant and Pre-emergence

Herbicide	Grasses	Broadleaves	Incorporate	Corn Tolerance
AAtrex	X	X	No	
AAtrex/Lasso	X	X	No	
AAtrex/Paraquat	X		No	
AAtrex/Sutan	X	X	Yes	Do not use on hybrid corn grown for seed
AAtrex/Princep	X	X	No	
AAtrex/2,4-D/oil	X	X	No	
Bladex	X	X	No	
Dalapon	X		No	
Eptam	X		Yes	Relatively poor
Knoxweed	X	X	No	
Lasso	X		No	
Maloran	X	X	No	Limited

Herbicides for Corn, continued

Preplant and Pre-emergence

Herbicide	Grasses	Broadleaves	Incorporate	Corn Tolerance
Paraquat	X	X	Nc	
Primaze	X	X	No	Chance of injury
Princep	X	X	No	
Princep/Paraquat	X	X	No	
Sutan	X		Yes	

Postemergence

Herbicide	Grasses	Broadleaves	Direct Spray	Corn Tolerance
AAtrex	X	X	No	
AAtrex/Dalapon/oil	X	X	No	
AAtrex/oil	X	X	No	Not as good as AAtrex alone
Banvel		X	Sometimes	Avoid corn leaves after 8 inches tall

Herbicides for Corn, continued

Postemergence

Herbicide	Grasses	Broadleaves	Direct Spray	Corn Tolerance
Banvel/2,4-D		X	Sometimes	Keep off corn leaves after 8 inches tall
Dalapon	X		Yes	Keep spray off corn leaves
Dalapon/2,4-D	X	X	Yes	
Evik	X	X	Yes	After corn is at least 12 inches high
Lorox	X	X	Yes	Keep off corn leaves
Outfox	X	X	No	Some early stunting may occur
2,4-D		X	Sometimes	
2,4-DB		X	Yes	Apply before tasseling

CALIBRATION OF APPLICATION EQUIPMENT

Rate of application, granular and sprays, may vary with materials used. Application equipment must be calibrated for each material applied to obtain accurate delivery. Here are suggested steps to calibrating three types of applicators.

BOOM SPRAYER

1. Clean sprayer and replace all worn or defective parts.
2. Fill tank with water.
3. Adjust spray pressure and speed of tractor for nozzle size and output using manufacturer's directions.
4. Spray ¼ acre (10,890 sq. ft.). Distance of travel will vary with boom width. For example, a 22 ft. boom must travel 495 ft. to cover ¼ acre:

$$\frac{\text{¼ acre (10,890 sq. ft.)}}{\text{Boom width (22 ft.)}} = \text{distance of travel (495 ft.).}$$

5. Measure amount of water needed to refill the tank. This amount was applied to the ¼ acre; thus, four times this amount is the gallonage per acre.
6. Adjustment in gallonage may be made either by varying tractor speed or by changing nozzle size. Recalibrate after making an adjustment.
7. Calculate acres covered by tank of spray solution, and add required amount of herbicide for total area to be sprayed.

BAND SPRAYER

1. Clean sprayer and replace all worn or defective parts.
2. Fill tank with water.
3. Adjust spray pressure and speed of tractor for nozzle size and output using manufacturer's directions.
4. Spray ¼ acre (10,890 sq. ft.). Distance of travel will vary with number of rows on the planter and row width. For example, band spraying over 4 rows spaced 40 inches requires 817 ft. to cover ¼ acre:

$$\frac{\text{¼ acre (10,890 sq. ft.)}}{\text{Rows (4) x row width (3.33 ft.)}} = \frac{\text{10,890 sq. ft.}}{\text{13.33 ft.}} = \text{distance of travel (817 ft.).}$$

5. Measure amount of water needed to refill the tank. This amount was applied to the ¼ acre; thus, four times this amount is the gallonage per acre.
6. Adjustment in gallonage may be made either by varying tractor speed or by changing nozzle size. Recalibrate after making an adjustment.
7. Calculate acres covered by tank of spray solution, and add required amount of herbicide for total *actual* area to be band treated.

GRANULAR BAND APPLICATOR

1. Set applicator dial or dials to give desired delivery rate of granules, suggested for band treatment, according to manufacturer's instructions.
2. Fill hoppers with granules to be used.
3. Travel across field at planting speed for the distance required to cover $\frac{1}{18}$ acre (2,722 sq. ft.) per row. Collect granules for *each* row in a bag, bucket or other container. For example, granular band application for 40-inch row requires 817 ft. to cover $\frac{1}{18}$ acre:

$$\frac{\frac{1}{18}\text{ acre (2,722 sq. ft.)}}{\text{Row width (3.33 ft.)}} = \text{distance to travel (817 ft.).}$$

4. Weigh granules from each row separately, and multiply by 16 to find delivery per acre for each row.
5. Adjust each setting, and recalibrate until the desired delivery rate is obtained.

SOURCE: Purdue University.

Lesson 8

DISEASES OF CORN

Objective -- To develop the effective ability of the corn producer to identify, prevent, and control corn diseases.

Problem and Analysis -- How can we identify, prevent, and control diseases in corn?

-Factors necessary for development of a disease
-Common diseases of corn in Kentucky
-Symptoms of the diseases
-Prevention and control of diseases

Content

I. Factors Necessary for Development of a Disease

For a disease to develop, there are three conditions that must be present -- suitable environment, causal organism, and a susceptible host. Many diseases develop when there is plenty of moisture during the growing season. Others require low temperatures, mild winters, or various fertility conditions. The main organisms that cause disease are either fungus, bacteria , or virus. Resistance to diseases differs considerably among inbred lines and hybrids, since it is determined by genes.

II. Common Diseases of Corn in Kentucky

The most common disease problems in seedlings are stalk rot and seedling blight. Diseases affecting roots and stalks are: diplodia stalk rot, gibberella stalk rot, charcoal rot, pythium stalk rot, and pythium root rot. Leaf diseases of corn in Kentucky are: northern corn leaf blight, southern corn leaf blight, Stewart's disease (bacterial wilt), common corn rust, crazy top (downy mildew), maize dwarf mosaic - MDM, and common smut. The ear rots are: diplodia ear rot (dry rot), fusarium kernel rot, nigrosporo ear rot (cob rot), gibberella ear rot (red ear rot), and gray ear rot. There are several species of aspergillus and of penicillium that cause rots in stored corn.

III. Symptoms of the Diseases

A farmer can follow these suggestions as an aid in overcoming his problems:

1. Recognize that a problem can exist at almost any time.
2. Be able to recognize problems when they do exist.
3. Be able to diagnose certain major diseases or types of diseases.
4. Call for expert help when it is needed.
5. As much as possible, plant hybrids known to be resistant or tolerant to the most common diseases.

IV. Prevention and Control of Diseases

The prevention of disease is essential, since it is not possible to control most of the diseases after they develop. Diseases can be prevented by using resistant or tolerant hybrids, treated seed, crop rotations, and by controlling weeds and insects, balancing fertility, harvesting early, and storing at 13% moisture. Fungicides are the only method of disease control in corn, and then only with some diseases.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Common disease problems found in the area.
2. Symptoms of these diseases.
3. How the diseases may be transmitted.
4. Preventive measures that should be taken.

B. Things to get from class members:
1. Corn diseases they have had.
2. What steps they use in controlling these diseases, and their success.
3. Practices used to prevent diseases.
4. Varieties of hybrids that are resistant to certain diseases.

II. Conclusions

A. A disease must have certain conditions present to develop. If any of these can be eliminated, the disease will not develop.

B. Many of the corn diseases are present each year, and measures should be taken to avoid a serious outbreak. Use resistant hybrids and change or eliminate any environmental condition that may induce a disease outbreak.

C. Maize dwarf mosaic is a serious disease where Johnson grass is present, so a MDM-resistant variety of corn should be grown where Johnson grass is present.

D. A problem getting more serious is molds that develop in stored corn. Corn to be stored for more than a few days should be dried to 13% moisture within 48 hours after harvest.

E. Maintain a balanced fertility program to prevent many of the disease problems that develop as a result of a shortage of one nutrient and excess of another.

III. Enrichment Activities

A. Identify the seedling, stalk, leaf, ear, and storage diseases in the local area.

B. Use pictures, charts, slides, films, or opaque projector to show an example of different diseases of corn.

C. Collect actual samples of stalks, ears, leaves, and kernels that are infected with diseases and pass them around in class.

D. List those practices which should be used in preventing diseases.

IV. Suggested Teaching Materials

A. References

1. Modern Corn Production, by Aldrich and Leng, pp. 206-253.
2. Corn Growers Guide, P.A.G. Division, pp. 87-102.
3. A Reference Unit on Corn, Mississippi State U. Agr. Edu. Dept., pp. 105-107.
4. Growing Corn in Kentucky, Cir. 588-A, pp. 9-13.
5. Bacterial Wilt and Stewarts Leaf Blight of Corn, U.S.D.A. Farmers Bulletin No. 2092.
6. Corn Diseases in the United States and Their Control, U.S.D.A. Agr. Handbook No. 199.
7. Corn Kernel Damage, Clemson College.
8. University of Illinois packet on corn production:
   A. Diseases of Corn in the Midwest, North Central Regional Extension Publication No. 21.
   B. Maize Dwarf Mosaic of Corn, VAS 4049.
   C. Corn Stalk Rots, No. 200.
   D. Stewart's Leaf Blight of Corn, No. 201.
   E. Northern and Southern Leaf Blights of Corn, No. 202.
   F. Common Corn Smut, No. 203.
   G. Storage Rots of Corn, No. 206.
   H. Corn Ear Rots, No. 205.
9. Advances in Corn Production: Principles and Practices, Pierre, Aldrich, and Martin, pp. 419-443.

B. Audio-visuals

1. Master
   -1 Common Diseases of Corn

2. Slides
   "Corn Diseases in Illinois," No. 732.

COMMON DISEASES OF CORN IN KENTUCKY

SEEDLING

Stalk Rot

Seedling Blight

LEAF

Northern Corn Leaf Blight

Southern Corn Leaf Blight

Stewart's Disease (bacterial wilt)

Common Corn Rust

Crazy Top (downy mildew)

MDM (maize dwarf mosaic)

STALK

Diplodia Stalk Rot

Gibberella Stalk Rot

Charcoal Rot

Pythium Stalk Rot

Pythium Root Rot

Common Smut

EAR

Diplodia Ear Rot (dry rot)

Fusarium Kernel Rot

Migrosporo Ear Rot (cob rot)

Gibberella Ear Rot (red ear rot)

Gray Ear Rot

80

107-8-1

BEST CONTROL = RESISTANT VARIETIES

Lesson 9

INSECTS OF CORN

Objective -- To develop the effective ability of the corn producer to identify and control insects of corn.

Problem and Analysis -- How can we identify and control insects of corn?

- Insects which damage corn
- Identification of insects which damage corn
- Damage done by insects
- Steps in reducing insect buildup
- Using insecticides
- Safety in using insecticides

Content

I. Insects Which Damage Corn

A. There are over forty insects which may damage corn. Some of these are found each year in corn, while others may appear only occasionally and cause damage. Insects which cause damage in corn from planting until it is knee-high are: seed-corn maggot, seed-corn beetle, thief ant, wireworm, cutworm, sod webworm, grape colaspis, white grub, common stalk borer, corn flea beetle, thrip, yellow striped armyworm.

B. From knee-high to tasseling, injury may be caused by these insects: chinch bug, fall armyworm; corn rootworms; Northern, Western, Southern, and European corn borer.

C. Injury-causing insects from tasseling to maturity are: woolybear caterpillar, corn leaf aphid, Japanese beetle, corn earworm, picnic beetle, corn sap beetle, European corn borer, katydid, grasshopper, Southwestern corn borer, and corn rootworm -- Western, Northern, and Southern.

D. Stored grain may be injured by: granary weevil, saw-tooth grain beetle, red flour beetle, rice weevil, Indian meal moth, cadella beetle, flat grain moth, angoumois grain moth, foreign grain beetle, and rusty grain beetle.

II. Identification of Insects Which Damage Corn

Insects which damage corn go through either a three-stage or a four-stage life cycle. The three-stage life cycle consists of egg, nymph, and adult. The nymph stage is the young stage of the adult and has the same appearance as the adult, except it may be wingless. The four-stage life cycle consists of egg, larva, pupa, and adult. The larva may be called a caterpillar, grub, or maggot. The larva and adult stages are the damage-causing stages. Insects have characteristics - color, markings, size, type of body, etc.- which are used in identification.

III. Damage Done by Insects

Damage done by soil insects is either kernel damage, root damage, or young-plant cut-off. Insects damage the corn plant above the ground by eating corn blade, eating silks, eating the ear, burrowing into the stalk, sucking sap from the plant, and eating the grain. In fields where soil insects are present in considerable numbers, the yield may be reduced 10 to 20 bushels per acre if untreated.

IV. Steps in Reducing Insect Buildup

Insect buildup can be reduced by these cultural practices:
-Rotate crops - soil insects tend to increase in continuous corn land.
-Select varieties that are tolerant to insect damage. There are no fully insect-resistant varieties.
-Destroy plant residue (tear up and plow under) which may harbor insects.
-Keep down weeds in the crop and adjoining fields.
-Use insecticides -- seed treatment, soil insecticides, and plant treatment.

Farmers often lose up to 10% of their stored grain to insects. Insects do the greatest damage to stored grain from May until October. Stored grain insects won't reproduce at temperatures below 60°F, and won't feed at 50°F or below. Some aids in reducing stored grain damage by insects are: select hybrids with good shuck coverage to prevent insects from laying eggs on grain while it is still in the field, harvest early to prevent as many eggs as possible from being laid on the grain, clean and fumigate storage facilities before storing, and treat grain as it is being stored or fumigate after storage.

V. Using Insecticides

Insecticides are now used on commercial hybrid seed corn now sold. Soil insecticides currently recommended are: Furadan, Bux, Thimet, Dasanit, Dyfonate, Mocap, Diazinon, Di-Syston, Sevin, and chlordane. For control of insects which feed on the plant, the present recommended insecticides are: Sevin, malathion, toxaphene, methyl parathion, Gardona, and Diazinon. The amount of damage being done by the insect and stage of plant development are determining factors as to when to use an insecticide as a foliar treatment. Dairy farmers cannot use the following insecticides: aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, or lindane because of residue in milk.

VI. Safety in Using Insecticides

A. Use insecticides safely to prevent harm to the person applying, and danger to other crops and animals; store where children cannot get to them.

B. Safety rules to follow with insecticides are:
   1. Wear rubber gloves when handling insecticide concentrates.
   2. Do not smoke while handling or using insecticides.
   3. Keep your face turned to one side when opening, pouring from, or emptying insecticide containers.
   4. Leave unused insecticides in their original containers with the labels on them.
   5. Store insecticides out of reach of children, irresponsible persons, or animals; store preferably in a locked building. Do not store near livestock feeds.
   6. Wash out and bury, burn, or haul to refuse dump all empty insecticide containers.
   7. Do not put the water supply hose directly into the spray tank.
   8. Do not blow out clogged nozzles or spray lines with your mouth.
   9. Wash with soap and water exposed parts of body and clothes contaminated with insecticides.
   10. Do not leave puddles of spray on impervious surfaces.
   11. Do not apply to fish-bearing or other water supplies.
   12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife.
   13. Do not apply insecticides near dug wells or cisterns.
   14. Do not spray or dust when weather conditions favor drift.
   15. Observe all precautions listed on the label.
   16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
   1. The insects that damage corn.
   2. Ways of identifying the insects.
   3. The type of damage done by each.
   4. What type of life cycle the most common insects have.
   5. Ways farmers can reduce the number of insects.
   6. Insecticides to use for controlling the insects.
   7. Safety practices in applying insecticides.

B. Things to get from the students:
   1. Insect problems they have experienced.
   2. The insecticides used and results obtained.
   3. How to adjust and calibrate sprayers.
   4. What protection and safety practices they use.

II. Conclusions

A. Be able to identify the insects, what part of plant they damage, stage of growth when damage occurs, and method of control.

B. Destroy residue on the land in the fall by chopping and plowing, if possible, to prevent overwintering of insects.

C. Reduce the number of weeds around and in the field to prevent insect buildup.

D. Know what insecticide to use and follow directions on label. Do not use insecticides on dairy farms that may cause residue in the milk.

E. Use insecticides safely to prevent serious problems.

III. Enrichment Activities

A. Have specimens, charts, slides, or pictures of insects to show and discuss in class.

B. Have containers of various insecticides used.

C. Make a chart listing insects, type of damage, time damage occurs, and insecticides to control.

D. Make a chart showing the amount of foliar damage before treatment should be administered.

IV. Suggested Teaching Materials

A. References
   1. Modern Corn Production, Aldrich and Leng, pp. 205-211, 217-218, 233-239, 244, 251-253.
   2. Crops '72, The Farm Quarterly, pp. 12-14.
   3. Corn Production, U.S.D.A. Agr. Handbook No. 322, pp. 27-30.
   4. A Reference Unit on Corn, Mississippi State U., pp. 109-114.

5. Profitable Corn Production, Iowa State U., PM-409, pp. 7-8.
6. Soils and Crops 12th Ed., Successful Farming Book, pp. 81-88.
7. Corn Growers Guide, P.A.G. Division, pp. 70-84.
8. Illinois Packet -
   Corn Insects and Their Control, VAS 4040a
   Corn Insects - Below Ground, Picture Sheet No. 5
   Corn Insects - Above Ground, Picture Sheet No. 4
   Principal Stored Grain Insects, Picture Sheet No. 1
9. Advances In Corn Production: Principles and Practices, Pierre, Aldrich, Martin, pp. 353-417.
10. Insecticides for Conventional and No-Till Corn, Ent.-16.

B. Audio-Visuals
   1. Film
      "Soil Insect Control," Modern Talking Picture Service

   2. Masters
      -1A,B Insect Pests of Corn
      -2 Insect Control in Corn

INSECT PESTS OF CORN

STAGE	INSECT
Planting to Knee-High	Seed-corn maggot Seed-corn beetle Thief ant Wireworm Cut worm Sod webworm Grape colaspis White grub Common stalk borer Corn flea beetle Thrip Yellow-striped army worm
Knee-High to Tasseling	Chinch bug Fall army worm Corn rootworms Corn borer - Northern Western Southern European
Tasseling to Maturity	Woolybear caterpillar Corn leaf aphid Japanese beetle Corn earworm Picnic beetle Corn sap beetle European corn borer Katydid Grasshopper Southwestern corn borer Corn rootworm - Western Northern Southern

Insect Pests of Corn, continued

STAGE	INSECT
Stored Corn	Granary weevil
	Saw-tooth grain beetle
	Red flour beetle
	Rice weevil
	Indian meal moth
	Cadella beetle
	Flat grain moth
	Angoumois grain moth
	Foreign grain beetle
	Rusty grain beetle

INSECT CONTROL MEASURES

- Rotate crops
- Select tolerant varieties
- Destroy plant residue
- Keep weeds down in adjoining fields
- Use insecticides properly

Lesson 10

HARVESTING AND STORAGE OF CORN

Objective -- To develop the effective abilities of farmers to harvest and store corn.

Problem and Analysis -- How should we harvest and store corn?

-When to harvest
-Methods of harvest
-Prevention of harvest losses
-Types of storage for the crop
-Drying the crop
-Prevention of storage damage

Content

I. When to Harvest

A. Corn is mature when grain is 30 - 32% moisture. The most desirable moisture level for least harvest losses is 24 to 26% moisture. Since most farmers cannot harvest all their crop at this moisture, many start at 28 to 30% and try to finish by the time the moisture level reaches 18%. When picking ear corn, moisture level must be below 20%. Early harvest advantages are:

1. less lodging from stalk rot and severe storms,

2. less chance of waterlogged fields which delay or prevent harvest,

3. ear drop is less,

4. less grain is shelled by the gathering head of the machine.

B. The decision of what moisture level to begin harvest will depend upon: number of acres, harvest equipment available, maturity variation in corn varieties being grown, if small grains are to be sown following the corn, drying facilities, market outlook, conditions of fields later in season, and amount of field loss that will occur.

II. Methods of Harvest

The way the harvest of the crop is done after it is produced will depend upon what the need is for the crop or what is to be done with it. The more common ways the crop may be harvested are as: silage, high moisture shelled corn, shelled corn, or ear corn. Harvesting the crop as silage, when kernels begin to glaze, will produce 70% more dry weight than it will as dry grain. Many livestock producers are harvesting corn at 28 - 32% moisture and storing in air-tight silos to prevent spoilage. Harvest at high

moisture results in lower field losses, no drying is required, and it is adapted to mechanized livestock feeding. When corn is harvested as high moisture, it has a tendency to bridge and not feed down in the bottom-unloading silos; it is not adapted to self-feeding during warm weather because of heating and spoilage; and in conventional silos unloading from the top, enough livestock must be fed to remove 3 to 4 inches daily during warm weather to prevent spoilage. Both harvesting as silage or high moisture limits one to marketing the crop only through livestock. Ear-corn harvest is still the most common method of harvest but in recent years, the combine is making shelled corn the common method.

III. Prevention of Harvest Losses

A. Harvesting all that is possible of corn produced is essential for profitable production. Regardless of how efficient the operator is, and even if corn is in ideal condition, there will be 1 to 2 1/2 bushels per acre that will be lost at harvest.

B. Tips for keeping losses low:

1. Run combine engine at proper "governed" speed and pickers at proper "P.T.O." speed.

2. Use a ground speed of 2.75 to 3.0 miles per hour. To determine ground speed, count the number of 3-feet steps taken in 20 seconds while walking beside the machine. Divide this number by 10 to get the ground speed in miles per hour.

3. Close stripper plates or snapper bars only enough to prevent ears from passing through.

4. Chain flights over stripper plates should extend beyond edge of plates 1/4 inch.

5. Ears should be snapped near upper 1/3 of snapping roll.

6. Drive accurately on matched rows spaced to your harvesting machine.

7. Gathering snouts should float on the ground and gathering chains should be just above the ground.

8. Measure losses and make corrective machine adjustments whenever crop conditions change.

C. One method of determining the field losses caused by the machine is:

1. Ear loss - stop machine at least 300 feet in from the ends of the field and where corn is representative of the entire field. Measure 1/100 acre in front of the machine (note: use master no. 10 - 4 to determine length of rows needed.) Count the number of ears in this area that are down where the machine cannot be expected to get. Then drive machine over this area and count the number of ears on ground. The number of ears down before picking subtracted from the number of ears after picking will give machine ear loss. Each 3/4 pound ear or equivalent in smaller ears represents one bushel per acre loss. Three 1/2 pound ears represent 2 bushels per acre.

2. Kernel loss - measure the area or construct frame that will measure 10 square feet, centered over the row. Count the number of kernels on the ground in the 10 square feet; each 20 kernels equal 1 bushel. Do this for each row of the machine's swath to get an average, because the machine will not evenly spread materials behind it. All kernels still attached to the cob are cylinder loss. Other kernels are usually snapping roll loss and separation loss. Total kernel loss and ear loss to find bushel per acre loss by machine.

IV. Types of Storage for the Crop

A. Types of structures for storage of the crop if harvested on the ear at low moisture level are varied, with emphasis being placed on prevention of insect, rodent, and weather damage when using these structures. Shelled corn presents more of a storage problem since very little is harvested at the safe moisture level for storage. Most must have some drying to prevent spoilage. The methods of storage and drying and their limitations are:

1. Dry and store in the same structure (layer drying) - fits farmers handling up to 10,000 bushels yearly. If unheated air is used for drying, the corn needs to be harvested at 18 to 22% moisture; if heated air is used, the corn may be harvested as high as 25%.

2. Batch-in-bin - for the farmer handling 7,500 or more bushels. Corn can be harvested at 18 - 30% moisture. Layers of corn from 2 to 4 feet deep can be dried from 25% to 14% daily.

3. Portable batch - for the farmer with 7,500 or more bushels. Corn can be handled up to 30% moisture with this method.

4. Continuous flow - for the farmer with 10,000 or more bushels. Corn at 30% moisture can be harvested for drying with this method.

B. If heat is used in any of these methods it will not matter what temperature is used for drying if corn is fed to livestock. Corn that is used for processing should not be dried at temperatures above 140°F, since it damages the starch and reduces the oil content in the grain. Commercial storage is available in most grain producing areas for farmers who do not have on-farm storage, or with more production than their storage capacity, and for renters.

V. Drying the Crop

A. The principle of drying corn is simply one of evaporating moisture from the corn. Moisture moves from one place to another according to a difference in vapor pressure; that is, moisture will move from an area of high vapor pressure to one of low vapor pressure. The vapor pressure of both corn and air depends upon the temperature and moisture content. The moisture content which corn attains in air of a given relative humidity (the ratio, expressed in percent, of the moisture actually in the air to the moisture it would hold if it were saturated at the same temperature and pressure) at a certain temperature is known as the equilibrium moisture content. The equilibrium moisture content is reached when the grain and the water vapor and the air are at the same temperature. If air at 80°F and 60% relative humidity is moved around wet shelled corn, the corn cannot be dried below 11.2% moisture content, which is the equilibrium moisture content. Drying with unheated air is less expensive, produces less fire hazard, and has lower initial cost of equipment. It is dependent on weather conditions, dries more slowly, and the longer drying time may result in damage by growth of mold. Drying with heated air is quicker, can handle wetter grain, and is not dependent on weather conditions. While it has higher drying capacity per fan-horsepower, it involves higher cost for initial equipment, and there is expense for fuel. It involves some fire hazard, and considerable supervision is required.

B. Shelled corn is purchased at 15.5% moisture content, so drying below this results in a loss to the grower. For short-term storage, this moisture level is satisfactory, but for long-term (4 months or longer) it should be dried to 13% moisture. Ear corn can be stored for a short period at 20 - 22% moisture, but should be dried to 17% if stored for 4 or more months.

VI. Prevention of Storage Damage

A. Grain can be stored over a period of several years with little or no loss of quality if stored under proper conditions. Often, spoilage occurs in grain as a result of microbes which develop. The conditions which influence the development of the microbes are:

1. The moisture content of the grain.
2. The temperature.
3. The oxygen supply.
4. The pH.
5. The condition or soundness.
6. The amount of foreign material present in the grain.

B. Corn stored should be handled properly to prevent the mold which produces the toxin named aflatoxin. Aflatoxin is one of the most carcinogenic and toxic materials known to affect mammals, fish, and birds. A dosage of only 0.5 ppm of aflatoxin reduced growth, while 2 ppm caused death in 1 to 3 days in swine. The result of aflatoxin in grain could result in condemnation of the grain and its being destroyed. Preventive practices to follow to avoid development of aflatoxin are:

1. Harvest as soon as moisture content allows without excessive grain damage.
2. Adjust combine for minimum cracking and maximum cleaning of grain.
3. Dry the grain as soon as practical, but reduce the moisture to 16% or below within 48 hours after combining.
4. Remove foreign material before storing the grain.
5. Clean the storage facility and treat for insects.
6. Store in water-, insect-, and rodent-tight structures.
7. Cool the grain after drying.
8. Aerate stored grain to control temperature and moisture migration.

Suggestions for Teaching the Lesson

I. Developing the Situation

A. Things to be brought out by the teacher:
1. Ways to determine the maturity of the grain.
2. What factors must be considered when deciding on the method of corn harvesting.
3. At what percentage of moisture can corn be harvested by the various methods.
4. How field losses can be estimated.
5. Ways field losses can be reduced.
6. The portion of the crop that is stored on the farm; the amount commercially stored.
7. The moisture content of corn for safe storage.
8. The types of storage and drying methods; and the amount of production needed to justify owning each.
9. What causes spoilage in grain.
10. How to reduce the danger of aflatoxin developing.

B. Things to get from class members:
   1. The moisture level at which they begin harvest.
   2. What are the methods of harvest they are using?
   3. Do they store their crop? If so, what method of drying and storage is used?
   4. How many are using dryers?
   5. What is their cost of drying?
   6. The materials they use to control insects in grain storage.

II. Conclusions

A. Early harvest of corn will result in less field losses and other jobs, such as seeding small grain, can be done on time.

B. Corn is mature at 30 to 32% moisture. Harvest can begin at these moisture levels provided facilities are available to handle grain with this much moisture.

C. Careful adjustment and operation of the harvesting machine will prevent much unnecessary loss. Check the amount of loss occuring from the machine, determine the cause, and correct if possible.

D. There are several methods of drying and storing corn. The amount of corn produced is a guide in determining the type of system you should have.

E. Corn stored should be dried to a moisture level to prevent spoilage. Shelled corn for short period 15.5%, long period 13%, and ear corn 17 to 20% depending on length of storage, are the safe moisture levels.

F. Handle corn properly to prevent development of aflatoxin during storage.

III. Enrichment Activities

A. During on-farm supervision check field losses at harvest.

B. Have representatives of equipment companies demonstrate the operation and adjustment of corn harvesting equipment.

C. Take field trips to observe different types of storage facilities and drying operations.

D. Use a panel of farmers to discuss different methods of drying and storage.

IV. Suggested Teaching Materials

A. References

1. Modern Corn Production, Aldrich and Leng, pp. 275-291.
2. Corn Growers Guide, P.A.G. Division, pp. 104-138.
3. Crops 72, The Farm Quarterly, pp. 44-45, 86-87.
4. Individual Study Guide For Drying Corn on the Farm, Ohio State University publication AGDEX 111/736.
5. Notebook: Grain Drying and Storage, Agr. Engineering Dept. U of K, 1973.
6. Storing and Drying Corn, University of Illinois, pub. VAS 4044.
7. Maintenance of Quality in Stored Grains and Seeds, Agr. Extension Service, University of Minnesota.
8. A Guide for Measuring Corn Harvest Losses, Ohio State University, AED-108.
9. Corn Harvesting, Handling, Marketing in Ohio, Ohio State University, Bul. 502.
10. Harvesting Corn with Combines, Bowers, Dept. of Agr. Engineering, University of Illinois.
11. The Economics of Drying Corn, Ky. Ext. Bulletin AEN-24.

B. Audio-visuals

1. Masters
   - -1 Estimating Moisture Content in Grain of Corn
   - -2 Estimating Percentage Loss of Weight when Grain Dries
   - -3 Pounds of Ear and Shelled Corn of Different Moisture Contents Equivalent to a Bushel (56 lbs.) of Shelled Corn at 15.5% Moisture.
   - -4 Row Length in Feet Per 1/100 Acre
   - -5 Field Losses
   - -6 Equilibrium Moisture Contents of Corn Relative to Air Temperature and Relative Humidity
   - -7 How to Tell When Corn Will Mature

2. Film:
   - -"Why Dry Corn?", The Venard Corporation

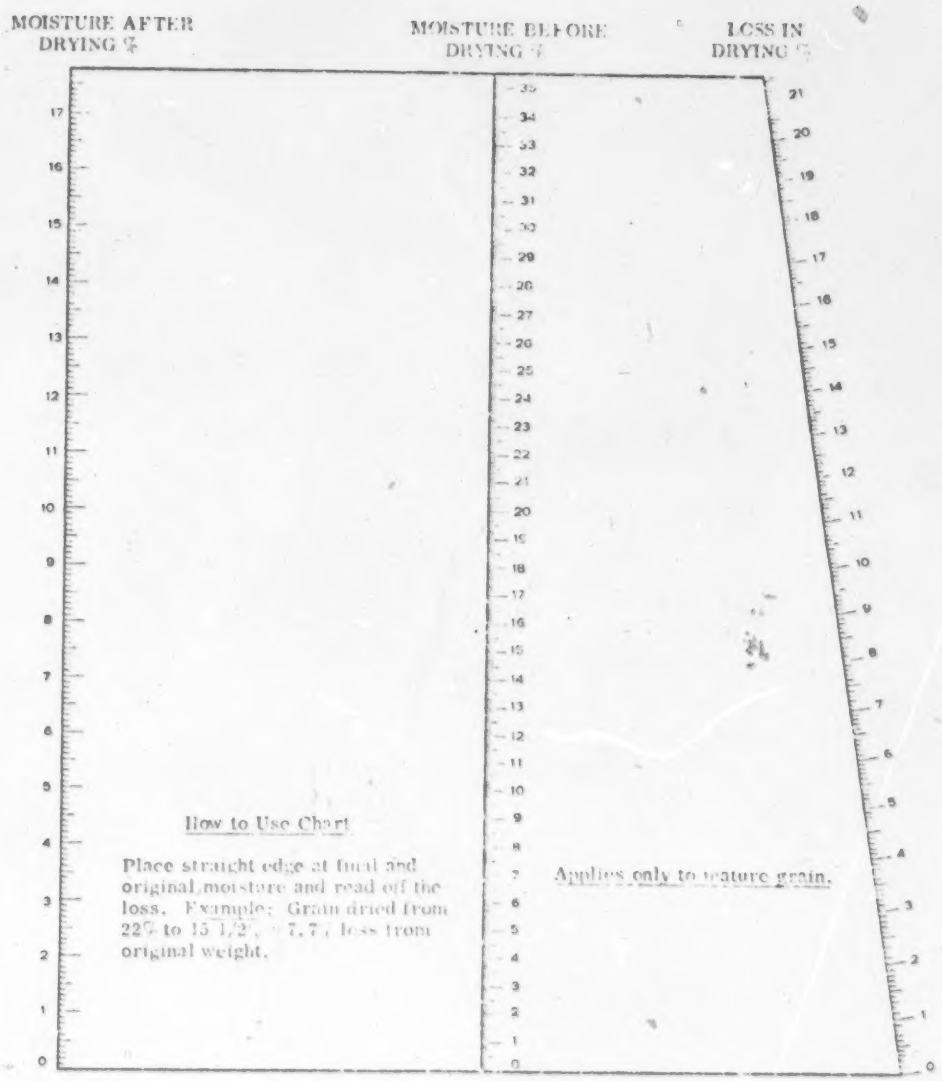
ESTIMATING MOISTURE CONTENT IN GRAIN OF CORN*

Description of Grain and Cob	Percent of Moisture in Grain
Wet; about half of the grain per ear dented.	60
Most ears well-dented; milk present in undented grain.	50
Kernels fully dented; germs still swollen; free water found in tips of grain by biting point of grain. Hard starch of kernel only partly developed and extending halfway down the back of the kernel, the remainder being soft, light-colored starch at the tip-end of the kernel; milk has been changed to soft starch at this stage. Ears solid; excess moisture gives the grain a glistening appearance.	40
Germs slightly swollen with free water in the tips of half the kernels. On the back of the kernel, the hard or "horny" starch should extend from the crown to the tip.	34
Germs rather smooth, swollen slightly at tip but slightly depressed at opposite end; free water in tips of very few kernels. Too wet to crib. Corn is made (ripe).	26
Germs concave (hollow, shrunken). Grains still drier than cob and ears slightly "twisty," with kernels not tight on the cob. Cribbing may proceed slowly at this stage.	23
All germs slightly concave; ears ready for rapid cribbing as indicated by the typical farmer "twisty" ear test; ears do not shell freely.	20
Germs moderately concave; kernels tight on cob.	17.5
Germs deeply concave; corn shells very easily; shelled grain rattles. On healthy ears, kernels are tight on cob, not loose or twisty.	15

NOTE: The grain loses moisture more rapidly than the cob, as indicated by the kernels loosening on the cob. As the cob loses excess moisture, the ear again tightens. It becomes solid when the grain and the cob have a moisture content of about 15 percent.

*Agronomy Department, Estimating Moisture Content in Grain of Corn (Lafayette, Indiana: Agricultural Extension Service, Purdue University, 1956), pp. 1-2. (Mimeographed.)

Source: Drying Corn on the Farm, Ohio Agricultural Education Service, p. 24.


MOISTURE AFTER DRYING %
MOISTURE BEFORE DRYING %
LOSS IN DRYING %
How to Use Chart
Place straight edge at final and original moisture and read off the loss. Example: Grain dried from 22% to 15 1/2%, = 7.7% loss from original weight.
Applies only to mature grain.

Lay a straight-edge along these points and read the figure it falls across in the "loss in drying column."

Source: Drying Corn on the Farm, Ohio Agricultural Education Service, p. 31.

107-10-2

Correcting yield for moisture
Pounds needed to equal 1 bu. #2 corn

Percent moisture	A Ear corn	B Shelled corn
15.0	67.89	55.67
15.5	68.40	56.00
16.0	68.94	56.33
16.5	69.51	56.60
17.0	70.09	57.01
17.5	70.69	57.36
18.0	71.31	57.70
18.5	71.95	58.06
19.0	72.60	58.42
19.5	73.27	58.78
20.0	73.96	59.15
20.5	74.60	59.52
21.0	75.36	59.90
22.0	76.79	60.66
23.0	78.25	61.45
24.0	79.76	62.26
25.0	81.25	63.09
30.0	88.50	67.60

Length of row for 1/100 acre

Row width	Length of row
20″	262 feet
30″	174 feet
32″	163 feet
34″	154 feet
36″	145 feet
38″	137 feet
40″	131 feet

FIELD LOSSES

Estimated No. of Days to Harvest Entire Acreage	Field Losses (%) for the Entire Acreage When Harvest Begins at these Moisture levels					
	30%	28%	26%	24%	22%	20%
8	3.0	2.7	2.5	2.6	3.1	4.4
14	2.8	2.6	2.6	2.9	3.5	4.9
20	2.8	2.8	2.9	3.3	4.0	5.4
26	3.0	3.0	3.3	3.7	4.5	6.1
32	3.3	3.3	3.7	4.2	5.0	6.7
38	3.7	3.7	4.1	4.8	5.6	7.5

Source: 1971 Class Summary, Christian Co. Adult Farmer Program.

107-10-5

EQUILIBRIUM MOISTURE CONTENT OF SHELLED CORN FOR VARIOUS AIR TEMPERATURES AND RELATIVE HUMIDITIES

Relative Humidity												
30	35	40	45	50	55	60	65	70	75	80	85	90
10.3	10.8	11.3	12.2	13.1	13.5	14.6	15.5	16.4	17.4	18.7	20.2	22.5
10.0	10.5	11.0	11.7	12.5	13.3	14.0	14.8	15.5	16.6	17.8	19.4	21.5
9.6	10.1	10.6	11.3	12.0	12.7	13.3	14.1	14.8	15.8	16.9	18.6	20.5
9.2	9.7	10.2	10.9	11.6	12.1	12.7	13.4	14.2	15.0	16.0	17.8	19.5
8.4	9.0	9.7	10.4	11.1	11.5	12.0	12.8	13.5	14.5	15.4	16.8	18.5
7.5	8.3	9.1	9.8	10.5	10.8	11.2	12.1	13.0	13.9	14.8	15.8	17.4

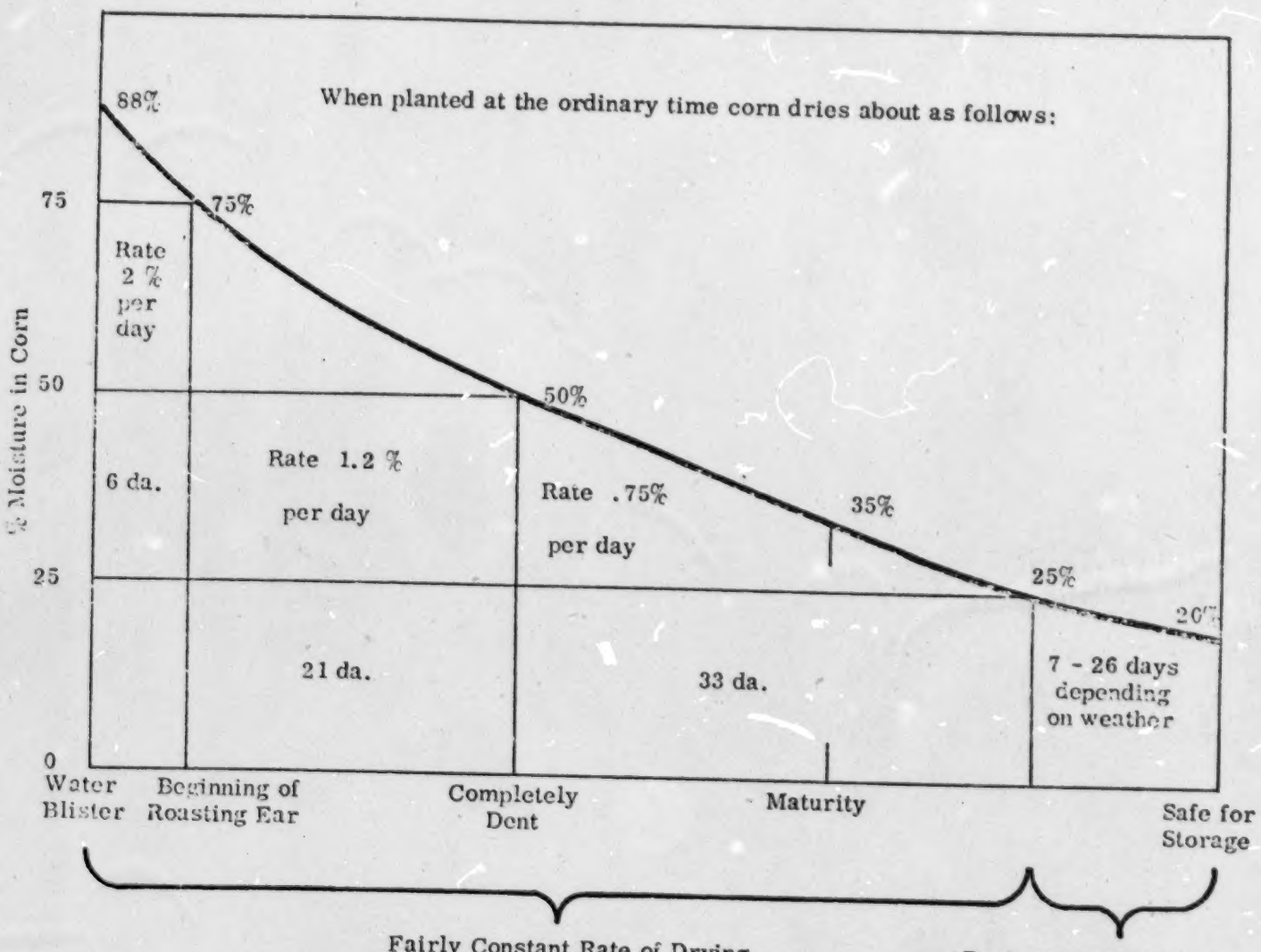
Can be overdried

Correct for long-time storage

Will not dry to safe moisture content under these conditions. Heat is needed

107-10-6

HOW TO TELL WHEN CORN WILL MATURE*



*USDA Agr. Research, September, 1955.

Source: Drying Corn on the Farm, Ohio Agricultural Education Service, p. 7.

Lesson 11

MARKETING CORN

Objective -- To develop the effective ability of farmers to profitably market corn.

Problem and Analysis -- How should we market corn to receive the most returns?

-Determining when to market
-Factors which influence prices during marketing season
-Dockage, shrinkage, and drying corn
-Marketing alternatives
-Grading of corn

Content

I. Determining When to Market

The question that confronts the farmer at harvest time, "When should I sell my corn?", is often very difficult to answer. The individual situation of the farmer will often help him to answer the question. Farmers without storage or with no commercial storage available, or who have bills, notes or mortgages due shortly after harvest have little choice other than to sell. Farmers with storage have a wider choice in that they may sell at harvest if the increase in price later in the season looks as if it will not pay to store, or they may store if indications are for a sizeable increase in price. In the past twelve years, there has been only one year that it was not profitable to store at harvest time and market later. The average difference in harvest time prices and highest prices later in the season over the past six years has been 29 cents for Kentucky markets.

II. Factors Which Influence Prices During Marketing Season

On the basis of a detailed study of corn prices, T.A. Hieronymus of the University of Illinois arrived at these general conclusions about the price trends through the season after harvesting begins:

A. Influence of the National Crop:

1. When there is a short corn crop the price peaks early in the season.
2. When there is a large crop following a short crop, there is relatively little price change.
3. A large crop following a large crop results in a larger-than-average price increase. (In other words, the price at harvest time takes a sharp dip; then, later in the season, a higher-than-average increase results.)

B. Influence of Other Factors:

1. The price increases during periods of improving general business conditions and declines as unemployment increases.

2. The price decreases when livestock numbers are declining and increases when they are increasing.

III. Dockage, Shrinkage, and Drying Corn

A. Selling at harvest time may appear to give a tremendous discount on high moisture corn, but about 40% of the discount is the difference in weight because of moisture. Discount is figured by different methods: some use a set rate of dock for each one percent moisture, and others use shrinkage and then a charge for drying on each percent of moisture. Corn (shelled) is bought on a 15.5% moisture basis.

B. Methods of Figuring Shrinkage:

1. Assume you have 6,390 pounds of shelled corn at 26% moisture and you want to know how many bushels of 15.5% moisture corn you have. A bushel of 26% corn weighs 63.9 pounds. Divide the 6,390 pounds by 63.9 pounds and you get 100 bushels of corn, corrected to 15.5% moisture. You have corrected for extra moisture since 26% moisture corn contains 7.9 pounds of extra water per bushel, a total of 790 pounds of excess water in the 6,390 pounds of corn.

2. Another method is by percent of original weight. For each 1% of moisture change, the weight will change 1.18%. In the above problem, the moisture was changed 10.5% (26 to 15.5%). To determine the percent of weight change, multiply 10.5 by 1.18, which equals 12.4% change or shrinkage. The shrinkage is calculated by multiplying pounds of corn (6,390) by 12.4, which will give 790 pounds shrinkage. Most grain dealers also add one-half of a percent for dry matter loss in both of these methods of discounting.

C. Dockage:

1. A set figure per percent of moisture in a bushel is used. With 26% moisture corn you would have 10.5% extra moisture times the dock would equal the cents per bushel dockage. Example: 10.5% extra moisture times 3 cents per point of moisture = 31.5 cents per bushel dockage.

2. Corn stored on the farm must be dried to a safe level of moisture. The operating cost of drying will be about one-third of a cent per point of moisture per bushel removed. Fixed cost for drying will be about 3 to 4 cents per bushel. Storage costs will run from 5 to 15 cents, depending on length of storage time.

IV. Marketing Alternatives

Other methods of marketing are contracts and hedging. Contract for a set price at a given delivery date provides the corn producer with certainty of what he will receive for that amount of production he contracts. Many farmers contract the amount of production to cover the production expenses and either store the remainder of the production or sell at harvest time. Some farmers use futures (or hedges) as a marketing tool. The farmer can use futures markets to: 1. fix the price of a crop prior to harvest, or extend pre-harvest pricing into the storage season; 2. fix the price of stored grains; and 3. speculate in the price of grain without storing it. If a farmer is planning to use futures markets he should understand their operation and also keep up to date on the market situation and outlook.

V. Grading of Corn

Corn is graded by its minimum test weight per bushel, moisture content, cracked corn and foreign material, and damaged kernels. There are six grades: 1 - 5, and Sample grade. Most yellow corn is bought as No. 2 grade and white corn as No. 1 grade.

Suggestions for Teaching the Lesson:

I. Developing the Situation.

A. Things to be brought out by the teacher:

1. Markets and marketing facilities available in the community.
2. Conditions when it is more profitable to store corn for later marketing.
3. Conditions when it is more profitable to sell corn at harvest.
4. Factors that affect seasonal variation in prices.
5. Ways to figure dockage and shrinkage costs.
6. What are the costs for drying and storing?
7. How the grain futures market operates.
8. Ways farmers can use the grain futures market.
9. What is "hedging"?
10. Where sources of information are available pertaining to prices, size of crop, amount of crop stored, and futures information.
11. Ways corn is graded.

B. Things to get from the class members:

1. How they handle the marketing of their corn crop.
2. What are their drying and storage costs for the ones who store?
3. Have they profited from storing and selling later?
4. The number who have sold on contract and their opinion of contracts.
5. The number who are using futures markets.

II. Conclusions:

A. The decision of whether to sell at harvest, store and sell later, contract for delivery at a set date, or use the futures markets will depend to a great extent upon the individual's situation.

B. The farmer should use information such as: the number of acres of corn being produced for the year in the U.S., the national crop outlook (low or high yield), the amount of previous year's crop carried over, the export demand, and the futures markets as guides in determining the price outlook.

C. When the farmer sells corn at harvest time that is higher in moisture than market standards, he will receive a discount. The farmer should be able to determine which of the discount methods used that he will receive the least amount of discount for his corn he plans to market. If there are markets in the area using the different methods of discounting, the farmer should sell on the market which will give him the greatest returns.

D. Farmers can know a long time in advance of harvest time what they will be receiving if they sell by a contract.

E. Futures markets are now used by some farmers to "hedge" on the price for their crop. If you plan to use the futures market, be sure you understand its operation and keep up with the market situation.

F. The reason for grading corn is to provide a set standard according to the grade. The use of grain for different purposes (feed, human consumption, alcohol production, etc.) requires different grades of corn. For example, No. 1 grade is used for human consumption.

III. Enrichment Activities:

A. Use a marketing specialist from the College of Agriculture as a resource person for this problem.

B. Use problems for teaching how to calculate storage and drying costs and for determining whether to store or market at harvest.

C. Use problems for teaching how to calculate shrinkage and dockage discounts.

D. Display samples of the different market grades of corn.

IV. Suggested Teaching Materials:

A. References

1. Modern Corn Production, Aldrich and Leng
2. Corn Growers Guide, T.A.G. Division
3. Grain Merchandising and Futures in Kentucky, Agricultural Economics Extension Information, Series No. 7.
4. Corn Kernel Damage, Clemson College
5. Notebook - Grain Drying and Storage, Agr. Engineering Dept. University of Kentucky
6. Storing and Drying Corn, University of Illinois, VAS 4044

B. Audio-visuals

1. Masters
   -1 Grades of Corn
   -2 A-C Figuring Moisture Discounts

2. Slidefilms
   "Determining Market Grades of Corn," University of Illinois, No. 734, $2.85
   "Factors Affecting Classes and Grades of Shelled Corn," University of Illinois, No. 734, $2.85

3. Films
   "Lock in Grain Profits by Hedging," John Deere Film
   "Grain Exchange," The Farm Film Foundation

Grades and grade requirements for yellow, white, and mixed corn

Grade	Minimum test weight per bushel	Maximum limits of—			
		Moisture	Broken corn and foreign material	Damaged kernels	
				Total	Heat damaged kernels
	Pounds	Percent	Percent	Percent	Percent
1	56	14.0	2.0	3.0	0.1
2	54	15.5	3.0	5.0	.2
3	52	17.5	4.0	7.0	.5
4	49	20.0	5.0	10.0	1.0
5	46	23.0	7.0	15.0	3.0

APPARENT AND ACTUAL PRICES AND DISCOUNTS IN MARKETING HIGH-MOISTURE CORN[1]

Moisture Percent	Apparent Discount Per Bushel Cents	Apparent Price Per Bushel Cents	Actual Price Per Bushel[2] Cents	Actual Discount for Marketing High-moisture Corn Cents
15.5	0	100	100.0	0.0
16.0	1	99	99.4	0.4
16.5	2	98	98.8	0.8
17.0	3	97	98.2	1.2
17.5	4	96	97.6	1.6
18.0	5	95	97.0	2.0
18.5	6	94	96.4	2.4
19.0	7	93	95.9	2.9
19.5	8	92	95.3	3.3
20.0	9	91	94.7	3.7
20.5	10	90	94.1	4.1
21.0	11	89	93.5	4.5
21.5	12	88	92.9	4.9
22.0	13	87	92.3	5.3
22.5	14	86	91.7	5.7
23.0	15	85	91.1	6.1
23.5	16	84	90.5	6.5
24.0	17	83	89.9	6.9
24.5	18	82	89.3	7.3
25.0	19	81	88.8	7.8

[1]When corn sells for $1 per bushel, moisture discount rate is 1 cent per each 1/2 Percent over 15.5.

[2]Price adjusted for extra weight due to moisture above 15.5 percent.

SHRINKAGE SCHEDULE AND DRYING CHARGES FOR SHELLED CORN

Moisture	Shrinkage	Drying Charge Per Wet Bu.	Moisture	Shrinkage	Drying Charge Per Wet Bu.
15.6 to 16.0	1.0%	0 ¢	23.1 to 23.5	10.4%	5 3/4 ¢
16.1 to 16.5	1.6	1/2	23.6 to 24.0	11.0	6
16.6 to 17.1	2.2	1	24.1 to 24.5	11.7	6 1/4
17.1 to 17.5	2.8	1 1/2	24.6 to 25.0	12.3	6 1/2
17.6 to 18.0	3.4	2	25.1 to 25.5	13.0	6 3/4
18.1 to 18.5	4.0	2 1/2	25.6 to 26.0	13.7	7
18.6 to 19.0	4.6	3	26.1 to 26.5	14.4	7 1/4
19.1 to 19.5	5.2	3 1/2	26.6 to 27.0	15.1	7 1/2
19.6 to 20.0	5.8	4	27.1 to 27.5	15.8	7 3/4
20.1 to 20.5	6.5	4 1/4	27.6 to 28.0	16.6	8
20.6 to 21.0	7.1	4 1/2	28.1 to 28.5	17.3	8
21.1 to 21.5	7.8	4 3/4	28.6 to 29.0	18.1	8
21.6 to 22.0	8.4	5	29.1 to 29.5	18.8	8
22.1 to 22.5	9.1	5 1/4	29.6 to 30.0	19.6	8
22.6 to 23.0	9.7	5 1/2			

MAXIMUM TIME FOR STORAGE OF SHELLED CORN AT VARIOUS CORN MOISTURE CONTENTS AND AIR TEMPERATURES[1]

Storage air temperature (fahrenheit)	Corn moisture content			
	15%	20%	25%	30%
	Days	Days	Days	Days
75°	116	12.1	4.3	2.6
70°	155	16.1	5.8	3.5
65°	207	21.5	7.8	4.6
60°	259	27	9.6	5.8
55°	337	35	12.5	7.5
50°	466	48	17	10
45°	725	75	27	16
40°	906	94	34	20
35°	1,140	118	42	25

[1]The times given are those above which mold growth will cause enough loss in corn quality to bring about a lowering of grade.

Source: United States Department of Agriculture, Guidelines for Mold Control in High-moisture Corn, Farmers' Bulletin No. 2238 (Washington, D. C.: United States Government Printing Office, 1968), p. 4.

APPENDIX

MY TEACHING PLAN FOR THIS COURSE

Why I am teaching this course (major learnings or outcomes expected)

_____

_____

_____

_____

_____

_____

ARRANGEMENTS FOR THE COURSE

Session No.	Date	Topic	Clock Hours

This page is for your convenience in planning and rearranging the content of this course to meet local needs and interests. Plan the course as it will be taught in the local school, showing the dates, class session number, topics, and the time in hours allocated to each topic.

TOPIC PLANNING FOR THIS COURSE

Name of Course _____

Name of Topic _____

Number of Class Meetings Allotted for this Topic _____

Teaching Objectives: (Learnings or outcomes for those enrolled)

Major Phases of the Topic: (Problems, jobs, areas, skills, key points, understandings, etc.)

Learning Activities: (Field trips, completing summary forms, panel discussions, demonstrations, etc.)

Teaching Materials Needed: (From resource material list or file)

RESOURCE MATERIALS FOR TEACHING

Unit _____ Lesson _____

Reference Books	Date Used	File Location

Other References: Bulletins, Magazines, Etc.

Audio-Visuals: Slides, Filmstrips, Motion Pictures

Magnetic, Flannel, and Bulletin Boards

Charts, Maps, Posters

Transparencies

Specimens, Models, Mounts

Human and Community Resources

Please complete and return to:
Maynard J. Iverson
7 Dickey Hall
University of Kentucky
Lexington, Kentucky 40506

ADULT INSTRUCTIONAL UNIT EVALUATION

-- A Questionnaire for Kentucky VoAg Teachers of Adults

PART I -- GENERAL INFORMATION

How many years of teaching experience do you have? _____

How many years have you taught adults in agriculture? _____

How long has it been since you have taken your last college classwork in agriculture____; in education _____: (undergraduate, graduate, or non-credit course)?_____

What is the highest degree you hold? _____

How many teachers are in your department?_____

What age level students do you teach? (✓one)
a) ____high school and adult b)_____adult only

How many other units from the University of Kentucky have you used in your teaching during the past few years?_____

PART II -- UNIT INFORMATION

NAME OF UNIT EVALUATED:_____

TYPE OF CLIENTELE TAUGHT: _____Adult Farmer ____Young Farmer
_____Other Adults (please specify)_____

Average number attending class _____

Was the interest level _____high? _____moderate? _____low?

How many lessons did you use?_____ How many class periods?_____

Indicate any lesson you added or deleted_____

_____

_____

_____

Directions: Place a check mark (✓) in the appropriate left hand column to rate the following components of the unit based on your own observations. A ranking of 5 represents an excellent rating decreasing to a rank of 1 for poor. For the open-ended questions please write on the back if additional space is needed.

Unit Design

5	4	3	2	1	
					General arrangement of parts
					Appropriateness of format for teaching adults
					Length of the unit
					Usefulness of suggestions for using the unit
					Number of lessons
					Order of lessons

Specific comments:_____

_____

PLEASE CONTINUE ON NEXT PAGE

Objectives in the Unit

5 4 3 2 1

_____ Clearly stated
_____ Reasonable to reach in the allotted time
_____ Relevant to needs of the adult learner
Specific comments: _____

_____

Technical Content

5 4 3 2 1

_____ Usefulness of introductory material
_____ Sufficiently detailed for direct use in class
_____ Related to objectives
_____ Divided into appropriate problem areas
_____ Up-to-date
_____ Accuracy
_____ Reasonably complete
Specific comments: _____

_____

Suggestions for Teaching the Lessons

5 4 3 2 1

_____ Appropriate information for the teacher to bring out
_____ Appropriate items to be secured from class members
_____ Suitable conclusions
_____ Suitability of enrichment activities
Specific comments: _____

_____

Resources and Teaching Aids in the Unit

5 4 3 2 1

_____ Up-to-date
_____ Accessibility to the teacher
_____ Relevance to the unit
_____ Adaptability to the teaching plan
Specific comments: _____

_____

With what parts of the unit do you feel you need additional help?

____ None of them
____ Objectives
____ Content
____ Course organization and planning
____ References
____ Resources and teaching materials
____ Teaching methods
____ Other (Specify) _____

PART III -- GENERAL REACTION

Please indicate any other strengths and weaknesses that you have observed in the unit and any suggestions for improvement, revision, and/or implementation (use the back of this sheet if needed).